APEX STANDARDS

3GPP Standards Lifecycle - Stage Complication and IETF Dependencies

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Stage 1 through Stage 3 in the 3GPP (3rd Generation Partnership Project) Technical Specification (TS) process delineate the development of telecommunications standards within the 3GPP framework. These stages collectively address various aspects of specification development, ensuring a balanced consideration of the interests of diverse stakeholders such as carriers, operators, and device manufacturers. Additionally, these stages are designed to navigate complex issues related to anti-trust and intellectual property rights (IPR).

Stage 0 (Pre-Stage 1 Activities, Informal)

While not formally recognized as "Stage 0," this initial phase is integral to the 3GPP standard development process. It encompasses the identification of needs for new or revised standards, driven by market demands, technological progress, or regulatory needs. Influential groups like NGMN, GSMA, or the Next G Alliance often steer this phase through recommendations and market research. For example, a carrier might propose a standard for network efficiency, or a manufacturer may suggest new device functionality specifications. These proposals, submitted by member entities, kickstart the standard development process and are evaluated within 3GPP groups. A study item is endorsed if deemed viable, leading to an in-depth study phase. This stage is critical for exploring technical options and their impacts, such as the effect of a new network protocol on device interoperability or IPR concerns. This foundational phase lays the groundwork for the subsequent formal development stages, starting with Stage 1.

Stage 1 (Service Requirements)

This stage defines service requirements from a user perspective. For instance, a carrier's interest in enhancing data speeds influences the service's scope and features, while a manufacturer focuses on compatibility and new functionalities. Stage 1 specifications ensure that the service addresses market needs and regulatory compliance, balancing operator demands with manufacturing possibilities.

Stage 2 (Architecture and Functional Specifications)

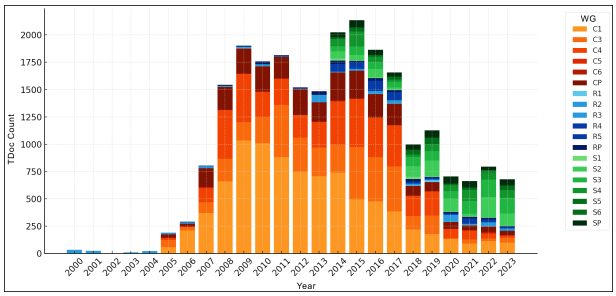
Upon completion of Stage 1, Stage 2 focuses on high-level architecture and functional specifications. It outlines how the service will be provided, including system design to meet Stage 1 requirements. This stage balances the technical feasibility for manufacturers with performance and efficiency metrics crucial for operators. For example, defining network architecture that supports new devices while maintaining existing infrastructure efficiency.

Stage 3 (Implementation Details)

The final stage involves developing detailed specifications for implementation, including protocols and operational procedures. These specifications are technical, serving as guidelines for developers and engineers. Stage 3 addresses the balance between enabling advanced features on devices and ensuring network reliability and security for operators. This stage is also where IPR issues are most prevalent, as specific implementation methods might infringe on existing patents, necessitating careful navigation of IPR landscapes.

3GPP-IETF Dependency: Key to Stage 2 and 3's Success

Central to the success of Stages 2 and 3 is the carefully coordinated dependence of 3GPP TDocs on IETF Internet Drafts (IDs). In these stages, there is a frequent referencing of IDs. Stage 2 focuses on defining the system's architecture and interfaces, regularly referencing IDs for protocols and technologies that are beyond the primary scope of 3GPP. This inclusion of IETF insights helps shape the architectural framework. Continuing into Stage 3, the emphasis shifts to implementing the architecture. Here, IETF standards guide protocol implementations, particularly in areas like IP Multimedia Subsystem (IMS), 5G systems, and security protocols for encryption and authentication. Their application extends to networking, including TCP/IP enhancements, YANG models, and new transport protocols.



This stacked bar chart depicts TDoc counts referencing IETF Internet Drafts annually, with TSG CT in orange, SA in green, and RAN in blue. Within each TSG, WGs are differentiated by gradients. The data peaks between 2008-2015, aligning with the 4G LTE standardization and a shift in mobile Internet applications. CT leads from 2004 to 2018, but SA surpasses in 2020, coinciding with the onset of Release 17 discussions and Georg Mayer's tenure as SA Chairman.

However, referencing outdated IETF versions poses several risks and challenges. Using older versions can cause compatibility issues with newer technologies and expose systems to unresolved security vulnerabilities. This also leads to interoperability challenges with systems using updated standards. The requirement for backward compatibility adds complexity and costs to system maintenance and upgrades. Additionally, keeping 3GPP specifications in sync with evolving IETF drafts, while addressing potential regulatory and compliance issues, dependency on specific vendors for outdated technology, and performance issues with older standards, complicates the situation further.

In the context of evolving technical standards, the case of SP-230612, *"Rel-18 CRs on security of SEAL Data Delivery enabler"*, serves as an instructive example. This TDoc referenced IETF ID draft-ietf-ace-oauth-authz-45 *"Authentication and Authorization for Constrained Environments using the OAuth 2.0 Framework"*, dated 2021-08-29. However, during the TDoc's creation, a later version of this reference, draft-ietf-ace-oauth-authz-46 (dated 2021-11-08 and eventually matured into RFC 9200), was available but not cited. This situation may have resulted from references being carried forward from an earlier Change Request (CR) without an update to the latest version, causing "versio obsoleta citata". The TDoc was approved in the 3GPP SA#102 Plenary Meeting in Taipei, June 2023, and integrated into the standard, TS 33.434 Ver 17.3.0, impacting technical clauses 2, 5, and subsection 5.1.1. This could present challenges for companies who implement that standard. It is important to note that such occurrences of referencing legacy versions are not isolated incidents but have been observed in various instances over time, highlighting an area for continual improvement in the standardization process.

To mitigate these risks, it is essential to adopt practices like regularly updating TDocs with the latest IETF drafts, ensuring strong coordination between the 3GPP TSG/WGs and the IETF WGs, performing consistent risk assessments, and involving all relevant stakeholders, including operators and vendors. Such diligent management is crucial for implementing updated and functional technologies while avoiding issues related to implementation, increased costs, and regulatory challenges. ∎

Reference

Georg Mayer, "3GPP-IETF Dependency Matrix"
https://whatthespec.net/3gpp/ietfdependencies.php

3GPP TS	Focus	Complications					
		General	Telecom Service Carriers/Operators	Device Manufacturers	Researchers (R&D) and Universities	Patent Portfolio Managers and Licensing Officers	Regulators and Policymakers
Stage 1	Defining user requirements and service scope	Ambiguity in user requirements, difficulty in foreseeing all user needs, balancing diverse stakeholder interests.	Difficulty in aligning network capabilities with evolving user requirements, managing cost vs. service quality.	Anticipating future network capabilities and user needs in device design, maintaining flexibility for evolving standards.	Identifying key areas of innovation and research based on preliminary user requirements and market trends.	Navigating evolving standards to maintain relevant and enforceable patents, managing licensing negotiations.	Ensuring regulations keep pace with evolving services and user requirements, balancing innovation with consumer protection.
Stage 2	High-level architecture and functional specifications	Challenges in defining efficient, scalable, and interoperable system architecture, managing technical feasibility within constraints.	Strategic planning for network upgrades and investment in new technologies, balancing legacy systems and future capabilities.	Aligning device firmware, hardware and software capabilities with new network architectures, ensuring compatibility and performance.	Developing theoretical models and prototypes to align with emerging network architectures and functional specifications.	Aligning patent strategies with developing network architectures and technologies, negotiating cross-licensing agreements.	Developing policies that encourage innovation in network architectures while ensuring fair competition and interoperability.
Stage 3	Detailed specifications for implementation	Complexity in technical details, ensuring compliance with high-level specifications, interoperability issues, and rigorous testing requirements.	Implementation of new standards into existing networks, managing network performance and customer expectations during transition.	Adapting devices to detailed technical specifications, ensuring compatibility, performance, and timely market entry.	Conducting in-depth research to solve specific technical challenges, contributing to the development of detailed specifications.	Keeping up with detailed technical changes for effective patent management and enforcement, mitigating infringement risks.	Creating regulatory frameworks that align with detailed technical standards, ensuring compliance and monitoring implementation.

In the 3GPP Technical Specifications process, each stakeholder faces distinct challenges across its stages. Telecom service operators align evolving network capabilities with user needs, manage strategic network upgrades, and integrate new standards, focusing on cost, quality, and customer expectations. Device manufacturers anticipate future network features for product design, ensure compatibility with emerging architectures, and adapt to specifications for market entry. Researchers and universities identify innovation areas, develop aligned models and prototypes, and tackle technical challenges. Regulators and policymakers synchronize regulations with evolving services, foster innovation while ensuring competition, and create frameworks aligned with detailed standards. Patent portfolio managers navigate evolving standards for patent relevance and licensing, align strategies with network developments, and manage technical changes for effective patent enforcement, reflecting a complex interplay of challenges in standardization.