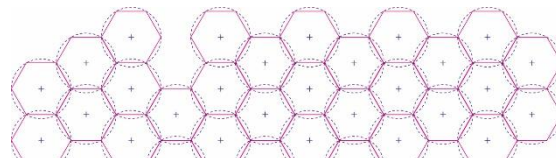


It is all down to timing – spectrum transitioning

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One of the more challenging aspects of spectrum management is ensuring the timely and orderly transition of frequencies where they are awarded to a new licensee. Where the frequencies are being used by incumbents to provide services, and there are no alternative providers or technologies available for end-users, it is particularly important to develop a well-thought through plan for transitioning to facilitate an orderly cessation of incumbent operators' activities in the band and enable new operators' services. The consequence of inadequate planning could lead to users losing services earlier than necessary and violation of universal service requirements or delays to the plans and provision of services by the new licensees. This Insight paper provides an overview of key issues and challenges with spectrum transitioning requirements built on Plum's extensive knowledge and practical experience in the area gained through assisting regulators and operators.

Demand for spectrum

The increasing demand for spectrum for new services, technologies and markets (for example vertical industries) can require existing users and uses to be transitioned earlier than has happened in the past. The outcome can be services and technologies being transitioned before the end of their natural life time to facilitate the entry of new more spectrally efficient technologies and more advanced services to meet emerging and expected significant user demand. This is increasingly seen with the demand for mobile broadband spectrum to enable more advanced LTE and 5G deployment. Furthermore, in some instances, release of spectrum may be underpinned by international harmonisation initiatives.

The process of releasing a frequency band for new use generally requires a cessation of incumbent network operations. In some cases, it may be possible to achieve this before the award of the frequencies to new users, but increasingly this is not an option with the increasing demand for spectrum access in certain key bands (e.g. 5G pioneer bands) and it is necessary to put in place:

- a firm date(s) for cessation of all incumbent services after the spectrum award; or
- a process to ensure new licensees can access their frequencies and roll-out their new networks and services as planned.

A transition plan can provide greater flexibility to both parties in terms of timing. Typically, such a plan will be developed through cooperation between the incumbent and new licensee – this has been particularly useful in the realignment of IMT spectrum blocks – but where there are limited incentives for the incumbent to release spectrum the development of a transition plan may need to be undertaken under the supervision of a spectrum management authority.

Transition plan development

The goals of a transition plan should be laid out by the spectrum management authority clearly to ensure that, in addition to minimising disruption to existing services, new networks are deployed according to timescales indicated by the new licensees and so ensure spectrum efficiency is not compromised during the transition period – it would be contrary to most regulators' obligations to ensure spectrum is not left unused for any significant time.

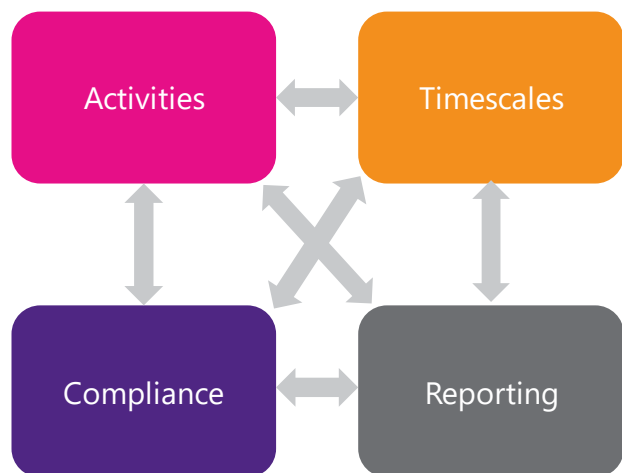
Typically, a transition plan is based on a phased approach where a new operator introduces its services in certain areas requiring the incumbents to modify or decommission their equipment. This requires a technical 'impact analysis' where potential coordination requirements that may occur during a transition period are determined for each transition party providing or aiming to provide services, for example, in areas of proximity.



Impact analysis plays an important role in defining details of a transition plan which includes transition activity categories and associated milestones, compliance clauses and reporting requirements.

Based on the findings of the impact analysis, requirements associated with four key transition plan elements shown in Figure 1 can be identified.

Figure 1: Key transition plan elements



These requirements can include the following.

- **Activities:** These could include decommissioning of incumbent operator sites and/or re-tuning frequencies of operation; and rollout plans for new operators.
- **Timescales:** Milestones associated with transition activities are vital constituents of a transition plan to ensure service continuation for users and spectrum access for the new licensee.
- **Compliance:** An essential component of a transition plan is compliance clauses where transition parties are incentivised to complete their activities in a timely fashion. These may be in the form of 'liquidated damages' accompanied by a 'grace period' to accommodate unforeseen events that could delay the completion of planned transition activities.
- **Reporting:** The spectrum management authority, as a body overseeing the transition activities, needs to be updated regularly to monitor progress being made by transition parties and as necessary act in a timely manner to address any potential problems.

Challenges

The technical impact analysis requires cooperation of all transition parties to define accurate network deployment and operational characteristics. Transition parties also need to agree on representative co-existence criteria to facilitate spectrum sharing during the transition period.

The cooperation of transition parties is also essential in describing potential solutions to address co-existence issues identified in the impact analysis. These may include site engineering solutions, for example, antenna re-pointing and/or moving to an alternative site to continue providing services during the transition period.

Transition activity milestones need to consider practical aspects of network decommissioning, modification and rollout which may result in the following associated challenges.

- An incumbent operator who is required to decommission its sites in a geographic area where a new operator is planning to deploy its own network should be capable of fielding a sufficient number of trained staff to undertake the decommissioning task within planned timescales. If necessary, they may need to notify users well in advance of transitioning, so they can seek an alternative service provider.
- Similarly, in the case of frequency re-tuning, an incumbent operator should have sufficient resources to perform the required tasks at network sites and, if necessary, user premises. If new sites or hardware acquisition are required, plans should be in place for site acquisition, hardware delivery, hardware installation and verification.
- The new network operator should be able to undertake rollout analysis; acquire sites; obtain, install and verify site hardware; and launch services within the projected timescales.

As a consequence of adopting a phased transition approach, planned decommissioning or re-tuning of incumbent sites might be prioritised to make efficient use of resources and minimise the impact on existing services. For example, new operator's planned sites could be deployed in those geographic areas where there are less sites that require transitioning.



Prioritising new operator sites as part of transition plan could reduce the impact on incumbent services.

Spectrum fees and implications

The impact on licence start dates, expiry and spectrum fees will also need to be considered. For example, in the case of IMT spectrum, fees are usually determined by auction and they represent the market value of the spectrum. For new licensees in the band (e.g. mobile operators) it is critical that there is sufficient clarity on transition plans and timescales ahead of the award so that they are able to take these into account in their valuation which will inform their bids for the spectrum. Information on the duration of the processes, the locations affected and procedures for dealing with delays to spectrum access should be clearly set out by the regulator ahead of the sale of the spectrum.

If such information is unavailable or only partially available prior to the award, or if unforeseen circumstances emerge during the

transition phase which then delay the usability of the spectrum, appropriate adjustments – discounts or phase-in period – may need to be made to the fees, or compensation to the new licensees may be necessary.

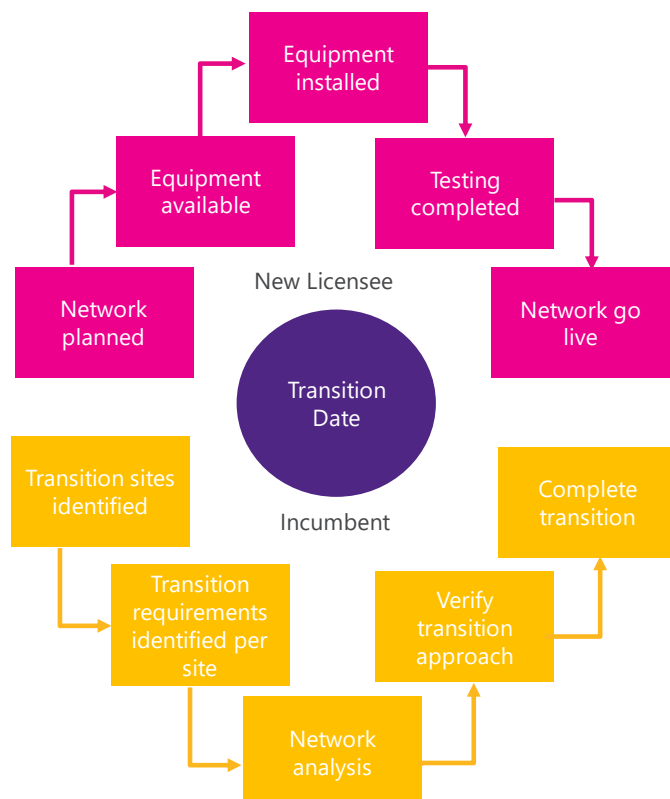
In principle, fees for access to same frequencies should be set to reflect the opportunity cost of the spectrum. Thus, the spectrum fees for incumbent uses should align with the value to the best alternative use which can be estimated through market value benchmarks or the least-cost alternative method. These should ideally be in place when long term spectrum allocation decisions are made in order to provide the right price signals on future usage of the frequencies.

This ensures there are adequate financial incentives for incumbent users to vacate the spectrum. If this is not already in place, then the regulator may consider appropriate increases or at least a signal of future fee hikes in order to hasten the transition.

Summing up

Transition planning involves many factors as shown in Figure 2.

Figure 2: Transition planning



These factors may often conflict with each other as an incumbent operator will typically aim to extend its operation as

long as possible while a new operator may want to rollout quickly in as many areas as possible – in particular to meet licence coverage conditions or gain competitive advantage. Therefore, a balance needs to be struck to ensure that the impact on users is minimised while spectrum efficiency is not compromised.

Migration plans of incumbent operators and rollout plans of new operators will also have to be taken into consideration for a successful transition plan implementation.



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Plum's spectrum transitioning capabilities

Our transition plan development activities include stakeholder discussions to understand and explore the issues related to the transition process; identification of regions and frequencies requiring transition activities through technical impact analysis; suggestions for a way forward to deal with any conflicts; and proposals for compliance monitoring against the transition milestone activities.

Plum's engineering team have many years of experience in developing impact scenarios, analysing them and identifying spectrum coordination requirements which form the foundation of an efficient transition plan development. We apply a combination of analytic calculations and deterministic/probabilistic simulation analysis to analyse the impact scenarios and identify appropriate conditions for coordination.

In addition, we have carried out a number of studies on spectrum valuation and pricing for governments, regulators and industry stakeholders. These include fees reviews for a wide range of services, including mobile (IMT), fixed links, satellite, broadcasting and private mobile radio.

Typically, transition plans will be subject to a consultation process. Plum can analyse submissions by stakeholders to such a consultation, develop an appropriate response and suggest amendments to the plan, where necessary, in collaboration with the national regulator.

Alternatively, Plum can assist new entrants or incumbents to respond to consultations and provide an independent assessment of proposals.

Example transition process

This section provides a list of steps that may have to be undertaken when developing and implementing a transition plan.

Let's assume that a frequency band is used by an incumbent operator to provide a service over a defined geographic area where

- there are no alternative networks to provide the same service;
- the incumbent operator needs to cease its operation in the frequency band concerned; and
- a new licensee would like to deploy its own network.

In this example scenario, the following process could be facilitated to ensure that there is no service loss for users served by the incumbent operator and the frequency band is not left idle. There are two potential outcomes considered here:

- Outcome 1: The incumbent and new licensee establish a direct communication and both parties agree to negotiate and develop a mutually satisfactory plan to implement the transition. The spectrum management authority is updated regularly on the progress until the process is completed.
- Outcome 2: The incumbent and new licensee cannot agree on a transition plan and the spectrum management authority needs to be involved in the process.
 - The spectrum management authority requests draft plans from both parties indicating their estimated timescales for decommissioning or re-tuning of existing sites and deployment of new sites together with radio frequency and deployment parameter values.
 - Data is analysed and verified by the spectrum management authority. Impact analysis is undertaken and incumbent sites that would be affected by the deployment of new operator sites are determined.
 - A draft transition plan based on a phased approach is developed where timescales are aligned by taking account of hardware delivery, installation and network verification. New operator sites resulting in a minimum number of affected incumbent sites are prioritised to speed up the network rollout.
 - The spectrum management authority launches a consultation process on the draft transition plan where the incumbent and new operator have the opportunity to provide their comments and suggestions.
 - Consultation responses are analysed, and the transition plan is finalised. The spectrum management authority informs both parties and sets out a timeline for regular updates on the transition plan implementation.

A specific example of where the development of a transition plan has been beneficial is for analogue terrestrial TV switch off

to free up spectrum for mobile broadband in the UHF bands. There are a considerable number of steps that need to be put in place and in a timely manner. For example, the following needs to be addressed:

- Decision on digital TV standards to be deployed and the future local, regional and national TV channels to be supported.
- Development of digital TV frequency plan.
- Award of relevant digital TV licences.
- Marketing plan to inform viewers of changes and the actions they need to take to ensure continued access to the terrestrial TV service.
- Deployment and switch on of digital network.
- Development of analogue TV transmitter switch off plan.
- Implementation of analogue network switch off plan.

It is likely that whilst there may be one overarching transition plan there may also be sub plans that cover specific activities such as the decommissioning of the analogue network.

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