

## An NREN Capability Maturity Model

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National Research and Education Networks are (mostly) organic, evolving, mutable entities that defy categorisation. There are nevertheless sometimes good reasons for imposing classifications onto them, especially if such abstraction helps us to think in terms of roadmaps or developmental paths. The following note uses a variation on the standard Capability Maturity Model to suggest one such categorisation. The model assumes that the formation of a NREN requires both consensus and collective action among the beneficiary institutions – that is, it applies to “bottom-up” NRENs. This of course is not always the case: many NRENs are formed as the result of government intervention, in a “top-down” that overlays a more or less fully formed NREN on the beneficiary institutions. And of course one can conceptualise hybrid models that blend the two approaches. In any event, the present note is limited to the “bottom-up” case.

**Level 0 (No NREN, no awareness of the need for one)** denotes not only the absence of an NREN, but also the absence of any widespread belief that such an entity might be appropriate or desirable. It is not uncommon in contexts where universities and research organisations conceive of themselves as essentially business entities, providing a service in return for a fee, and not especially dependent upon collaboration with one another, nor upon connectivity to research and education networks elsewhere. “The Internet” is conceived of in this context as a commodity resource rather than as a platform for the advancement of scholarship or education. The university-as-business culture does not, in general, provide very much scope for the collaborative initiative that might trigger the emergence of an NREN. Sometimes, however, a lack of awareness might be the result simply of a lack of exposure to working NRENs and to the benefits that flow from them. Very often an acute scarcity of bandwidth characterises such gaps in awareness. In the latter case there is manifestly scope for the kind of lobbying that might lead to the next step.

**Level 1 (No NREN, but consciousness of the lack)** is still characterised by the absence of an NREN, but there is a generalised, disseminated awareness that there is a benefit to be had from the establishment of one. Such awareness often flows from exposure to working NRENs, or from frustrated attempts at scholarly collaboration. Sometimes it is simply a response to a bandwidth shortage, and can lead to the establishment of a bandwidth-buying club, which, while not in itself an NREN, can be an important stepping-stone on the way to one. Awareness, however, does not equate to collective action. Level 1 can involve lots of discussion and complaining, but very little more. It is however fertile ground for promoting measures that lead to the next level.

**Level 2 (No NREN, but structured conversation)** is different from Level 1 in that a focussed and systematic discussion is taking place about how to form one. This is not strongly distinct from Level 1, except that there has been an advancement beyond disempowered grumbling, towards an exploration of the horizon of possibility. Such exploration might take place under the auspices of existing structures, such as associations of university vice-chancellors; it might be triggered by donor initiatives;

or it might be precipitated by changes in the technical or regulatory environment. Typically it requires leadership, and indeed this is a critical factor in this and the next two stages. Structured conversation does not, in and of itself, lead to the formation of an NREN: conversation can proceed for years, without results.

**Level 3 (Establishment of commitment)** is reached when the potential beneficiaries enter into a formal undertaking to one another – typically in the form of a memorandum of understanding - to establish an NREN and to use its services. This is more difficult to achieve than it sounds, since collaboration involves sacrifice: the participants must give up some freedom of action to achieve a larger objective. Such decisions are the essence of strategy, which can be defined as the sacrifice of the lesser for the greater. Nevertheless such outcomes can be extraordinarily difficult to achieve, since they involve a shift in mindset. If benefits follow then mindset change eventually becomes encoded in organisational culture, but before the delivery of such benefits the willingness to collaborate is something of a shot in the dark. This can be a very delicate phase of NREN formation: it requires careful management of change and the achievement of early wins to lock in collaboration. A failed initiative makes it much harder to restart collaboration in the future.

**Level 4 (Coherent service offering)** marks the first point at which one can speak of an NREN in existence. The memorandum of understanding has been translated into formalised organisation structure, and contracts with service providers and with beneficiary institutions. Such contracts necessarily require the legal capacity to contract, and hence the establishment of an organisation with a legal persona. In its simplest form the new NREN might simply be a consortium to leverage collective buying power. Such consortia have considerable potential to develop into more mature NREN structures, but they are also at considerable risk: they are cordially disliked by providers, who are not always unwilling to take measures to break the underlying collaboration (such as loss-leader offers, or attempts to cherry-pick the major participants.) It is critically important in such contexts for the executive leadership of participating institutions to sustain the willingness to collaborate and to focus on the achievement of long-term benefit, even if this involves the loss of short-term gains. The pure purchasing consortium remains vulnerable as long as its only benefit is price, and the realisation of additional benefits should be an early objective.

**Level 5 (Regional or better connectivity)** is reached when the NREN is participating in a technically coherent way in regional, continental or global connections to other NRENs or NREN groupings. The immediate benefits include faster or more efficient connections to other research and education institutions, access to otherwise inaccessible resources, and participation in a REN-specific community of practice.

**Level 6 (Elaborated service offering)** marks a fully mature NREN of the kind that characterises Europe, North America and comparable contexts. The NREN is richly connected at high speed to many other networks and resources. Numerous value-added services are available, such as grid and cloud computing resources, user-controlled lightpaths, videoconferencing, and federated identity services. The NREN's value proposition lies primarily in these services, since bandwidth pricing in such contexts is transparently cost-related. Many institutions will purchase commodity bandwidth from a commercial provider in addition to NREN-specific bandwidth. A culture of collaboration is deeply established.

This model is, obviously, open to contestation. The differentiation, in particular, could be cast in different ways: some levels could be collapsed, while others could be expanded or elaborated. The value of thinking along this axis is not so much in the

levels themselves, but in the broad conceptualisation of NREN evolution. A capability maturity model automatically gives rise to some conception of a roadmap, and assists to identify points of intervention or leverage. In particular, models of this kind allow us to clarify obstacles, and to think about how they might be removed or circumvented. For example, some of the early stages in NREN formation cannot take place at all if the policy or regulatory environment is unduly hostile. In such cases, policy and regulation are themselves the spaces in which intervention is required.

Of critical importance at all levels, but especially in the early phases, is the role of leadership. It is leadership which dramatises the lack of NREN activity and persuades potential beneficiaries to begin demanding progress. It is leadership that breaks out of ineffectual grumbling and into structured conversation; it is leadership which makes it possible to traverse from conversation into commitment, and which translates visions into action.

Deficits in leadership are almost invariably the result either of organisational deficits or of human overload. In the former case organic leadership is present but is rendered ineffectual by clumsy or impenetrable processes. In the latter case, leadership is present and effective but overcommitted.

The model presented here is not intended as a Procrustean bed, and due sensitivity to local circumstance is always required in assessing any level of NREN development. As an analytical point of departure, however, it may be useful, either in itself or as a stimulus towards alternative characterisations.