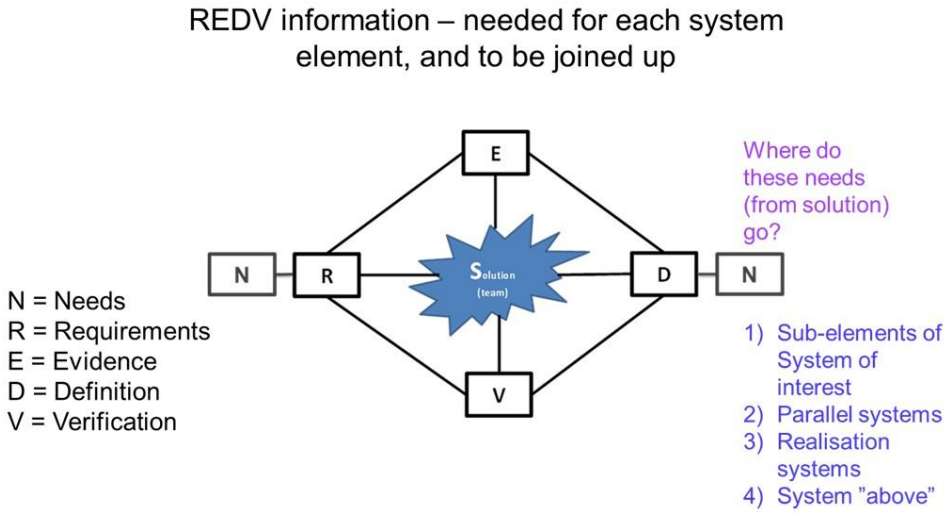
The REDV information model for Systems Engineering

An important aspect of Systems Engineering is the information produced by the various technical processes. We need to

a) Manage the data (keep it up to date) – especially as there is a lot of change, especially early on
b) Establish the traceability – between different types of data and between layer (the connection between the layers is not covered in this brief document).

The fundamental starting point is a data architecture. During my time as a SE capability manager, considering the need for traceability and need to explain the kernel of the data management the REDV diamond model was developed – the figure below shows the latest version of it



Explanation of the elements in this model

1) **The Solution** -The prime outcome of engineering is a solution – and the solution here is that for a given system of interest (a complete solution will be the connection of the descriptions of all the elements and how to put them together). This REDV model applies to every layer / element in the whole system.
2) **Needs** – these are associated with stakeholders – and define what a stakeholder expresses as needed from the System of interest. In this model Needs are either inputs to the development coming from the range of stakeholders of the system, or outputs (when solution becomes a stakeholder of other systems) expressed to other systems (including, but not only, the sub-elements of the system of interest).
3) **Requirements** – these are the output of elicitation and then analysis of the needs from all stakeholders. Requirements define what the system has to do, how well it

has to do it, the conditions under which it operates and the system attributes that constrain the system.

4) **Evidence** – this is the result of analysis of desired system or function performance attributes. This is to assist the design, evaluate concepts against the requirements, and to help in the derivation of derived needs for other aspects. It can be seen as an "interim verification" – (suitably confident to proceed), but is more than just "does the solution satisfy the requirements).
5) **Definition** – this is probably the trickiest aspect to describe. For Systems Engineering data management consideration it is the definition of, for the given solution, what that solution needs from its sub-elements and any other supporting or related system the solution depends on – so it is what the solution needs (from other systems) to work.
6) **Verification** – verification is a very specific activity that addresses whether the solution HAS met the requirements. In regulated industries a sub-set of this is the formal certification of the solution.

In developing this model the most clarifying development was removing any arrows or direction to the connectivity. The point is that there need to be connections between everything, and at any point in time the R, E, D and V are expressions of current understanding, connection and state – and review of discrepancies allows the fast proactive adjustment

Managing R, E, D and V in documents is very hard – because you want to manage connection / links to individual elements (e.g. a single requirement) not just the documents, and there is (especially in the early stage) a lot of uncertainty and change. Therefore a database or better modelling approach is needed. The idea is that R, E, D and V are "views" of the solution, and represent the current understanding, and any gaps or inconsistencies are a prompt for activity (at an appropriate point).

Later posts will discuss

- Detailed descriptions of each of these sets of information
- how the REDV of different systems elements at different levels is joined up.
- How the REDV data links to technical management processes – especially Risk, Configuration and Decision management, and the overall planning of the system development.