

## THE VALUE OF A NETWORK - THE $\mu$ FACTOR

The "value" of a network is important when planning its strategy and its priorities of development. Two "laws" about interactive networks are often referred to, where  $n$  is the number of network participants:

- the value of a network is equal to  $n^2$ , considering all the bilateral possible relations (Metcalfe's law)
- the value of the network is  $2^n$ , to consider the many too many relations (Reeds' law).

These are the maximum numbers of possible connections. An analysis shows that most y of the considered connections will never happen.

- the global value of a network is by nature the  $\Sigma$  of its values for each of its participants, a value which will probably depends on their reasons for using it. This explains why one does not sell a network to its users (too many sales pitches), but to the one who is the most interested in the network being used. Because his interest will outweigh everyone else's interest, while his interest is easier to identify.
- the global value of a network is also the  $\Sigma$  of the values of each of its externets.
- a network permits users to get more pertinent responses/relations than the ones he already has. The more he gets, the less there are better ones left. Attrition will be the same for family, relations, friends, business, etc. This is why " **$n \cdot \log(n)$** " is a better law. From different premises Mr. A. Odlyzko published a good mathematical analysis of this part (<http://www.dtc.umn.edu/~odlyzko/doc/metcalfe.pdf>).
- mankind needs communications tools, in relation to human density, to support languages, the human communication protocols. The denser men, the more their communications are complex, the more they need assistance, the more they have tools, assistance and now ubiquitous services, the more they can use them, etc. This sounds like an atomic reaction (as in the quoted Reeds' law). Yet human density also acts as a relational filter/screen in every direction: the Metcalfe's law applies negatively (since everyone interferes with everyone) with a factor " $\mu$ ". " $\mu$ " is the pollution noise of the network. It measures the pertinence the user will really get vs. the pertinence he looked for.

$n \cdot \log(n) - \mu \cdot n^2$
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Remarks above show that the real value is  $\Sigma$  (users)  $\Sigma$  (externets)  $(n \cdot \log(n) - \mu \cdot n^2)$ . In general purpose/usage networks, integrating sigmas into " $\mu$ " speaks better.

The whole network management will consist in best managing  $\mu$  ( $\mu=0$  means the network is transparent).  $\mu = \log(n)/n$  is the saturation curve: this is a self regulation state where the network has a 0 value, losing members until  $\mu$  decreases (or is made to decrease) and the network may grow again. One sees that the formula does not give an absolute value but a value of replacement which permits to foresee changes i demand and network life cycles.  $\log(n)/n$  is the obsolescence curve. The "value" describes the resilience of the network. Up to now, the international network life time cycle (cf. Tymnet, OSI, Internet) seems to be from ten to fifteen years.

- $\mu$  is a brainware-oriented factor since it reflects the satisfaction of the user. What counts is what the user thinks the network does, not what the network really does.
- spam is an example of what may increase  $\mu$
- breaking the perception of the network into local, regional, national, lingual externets will decrease  $n$  for each externet. This will increase specific interests and reduce  $\mu$ . This will diminish the risk of crossing the obsolescence curve. The global value, i.e. the sigma of all the externets, will increase.
- this explains why priorities will switch from deployability governance to scalability intergouvernance as the network stabilises. The initial  $\mu$  targets at operation satisfaction and accepts an IPv4 routing. The number of users calls for a drastic reduction of  $\mu$ , and therefore for a carefully thought planning.