

*Revised and Updated 2<sup>nd</sup> Edition*

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**Advanced Networks Set**

coordinated by  
Guy Pujolle

Volume 1

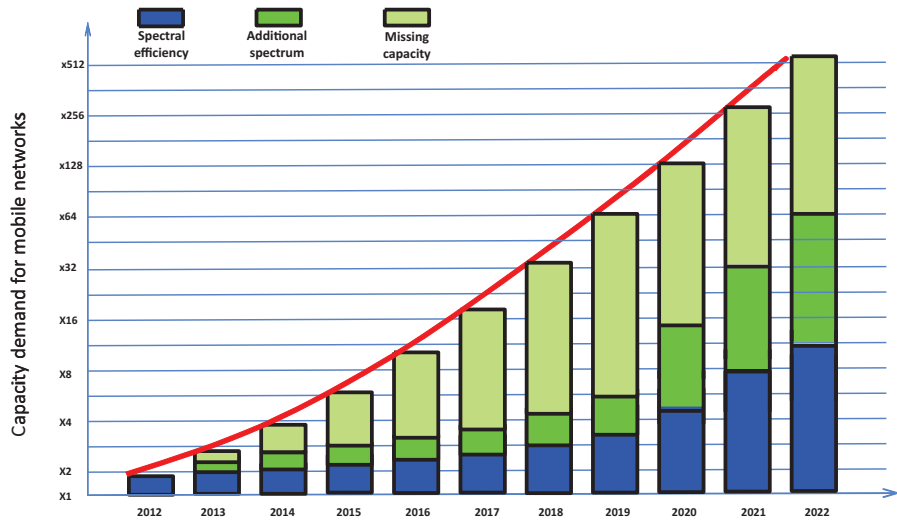
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# **Software Networks**

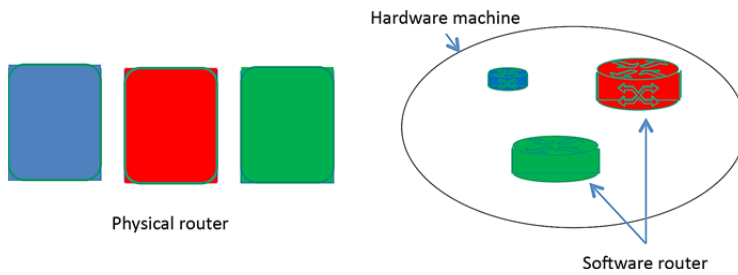
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*Virtualization, SDN, 5G and Security*

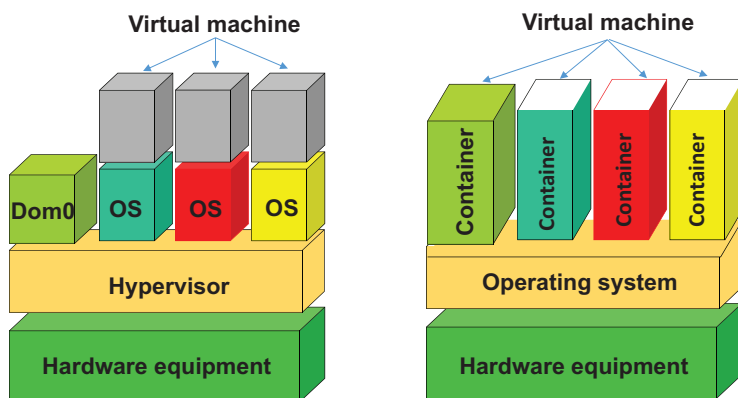
Guy Pujolle



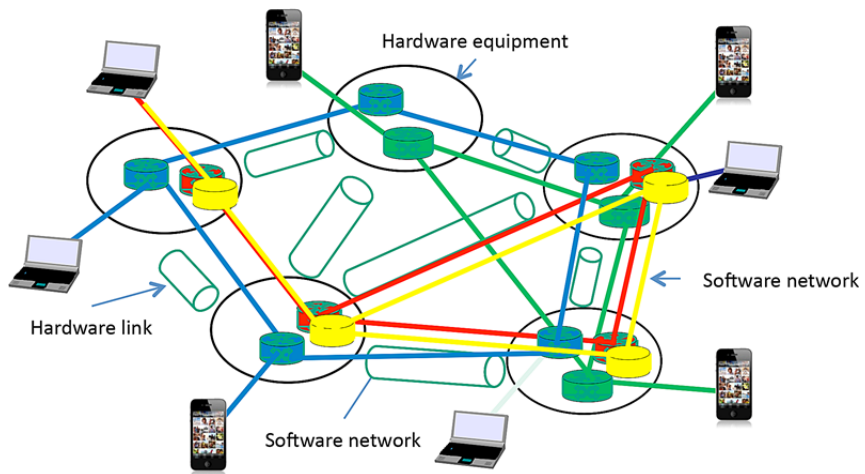
**Figure I.2.** *The gap between technological progress and user demand*



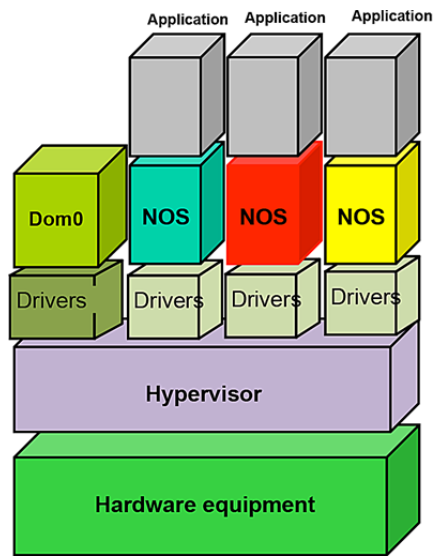
**Figure 1.1.** *Virtualization of three routers*



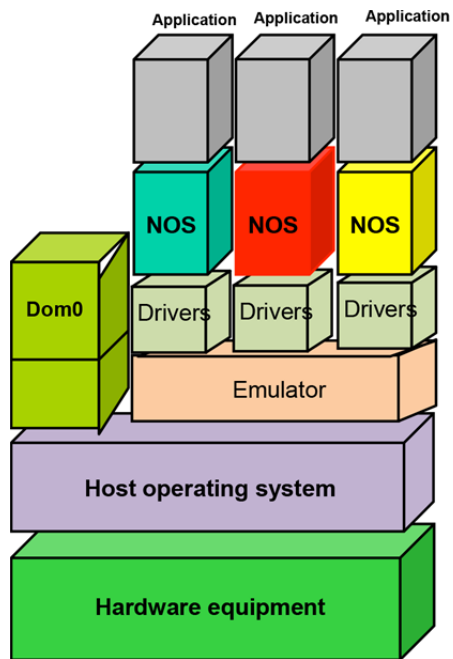
**Figure 1.2.** *A virtualized machine*



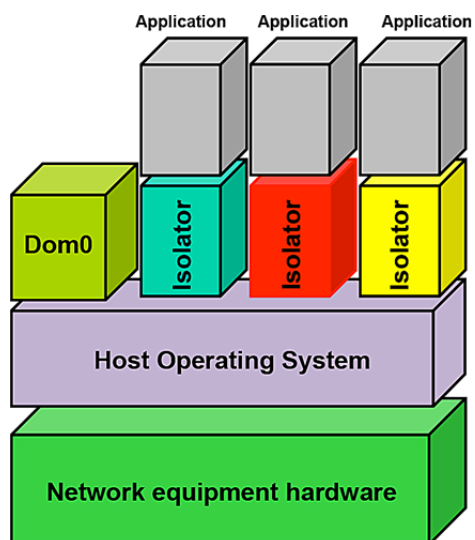
**Figure 1.3.** *A set of software networks*



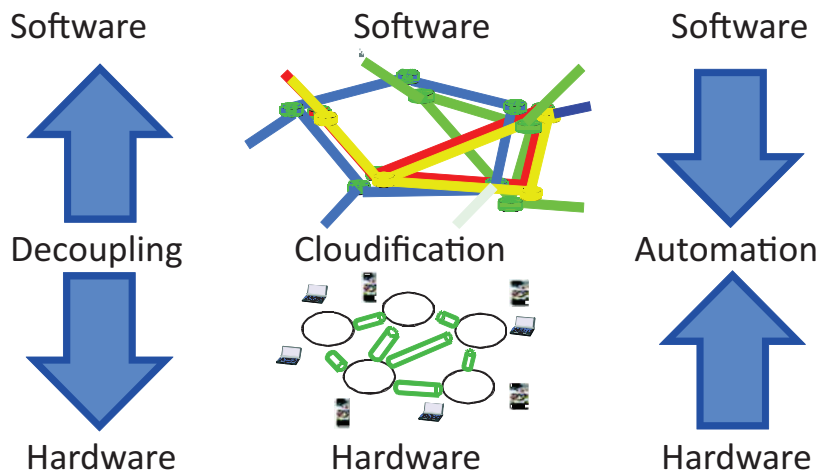
**Figure 1.4.** *Paravirtualization*



**Figure 1.5.** *Virtualization by emulation*

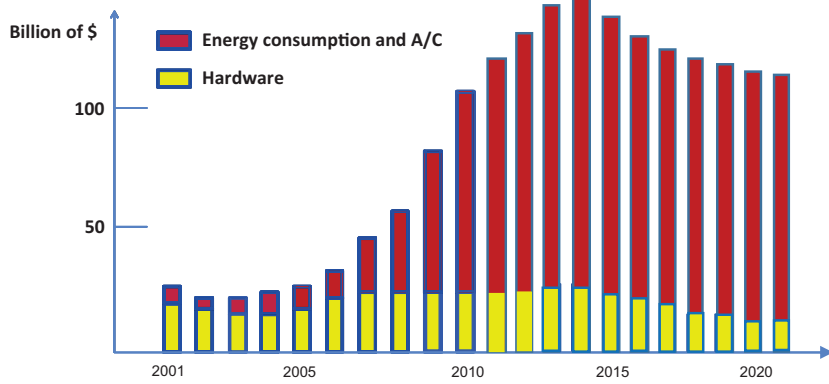


**Figure 1.6.** *Virtualization by container*

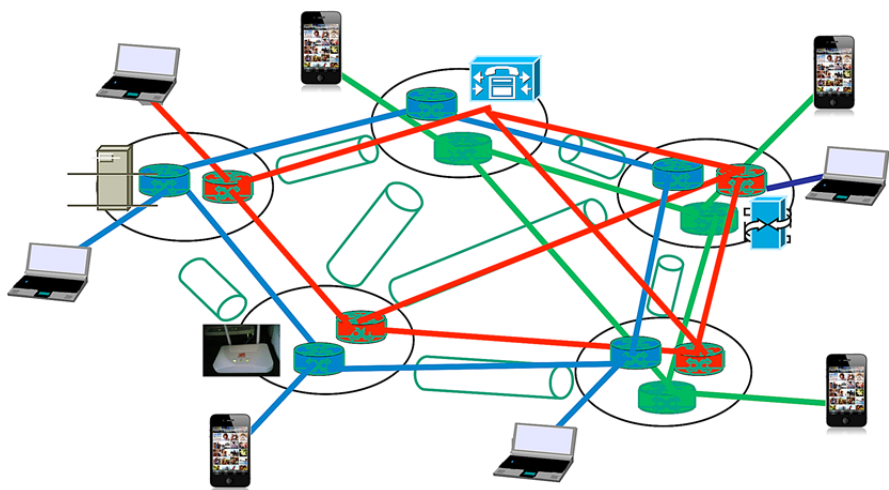


**Figure 2.1.** *The three basic principles*

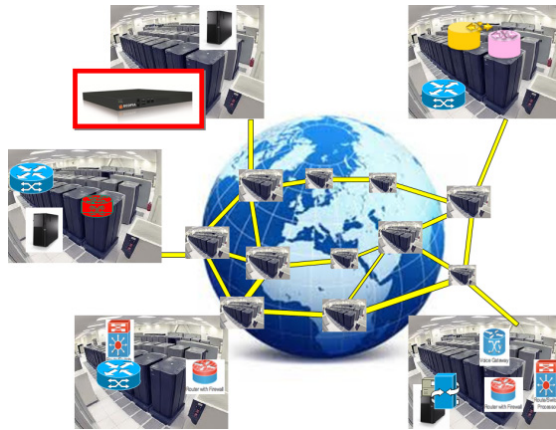




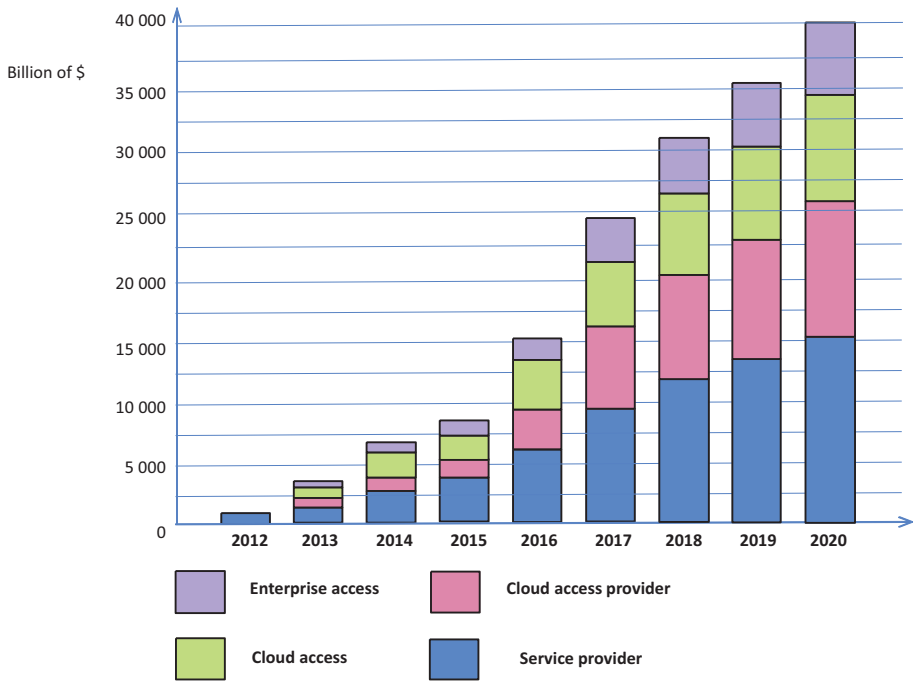
**Figure 2.15.** *The cost of a datacenter environment*



**Figure 2.16.** *The urbanization of a network environment*



**Figure 2.17.** *Vision of tomorrow's SDN networks*



**Figure 2.18.** OpenFlow market, and more generally SDN market

## The Linux Foundation Leads Open Source Momentum

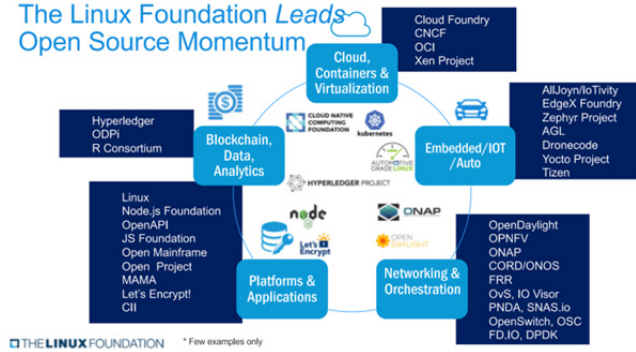


Figure 4.1. Linux Foundation's projects

# Open Source Networking Landscape

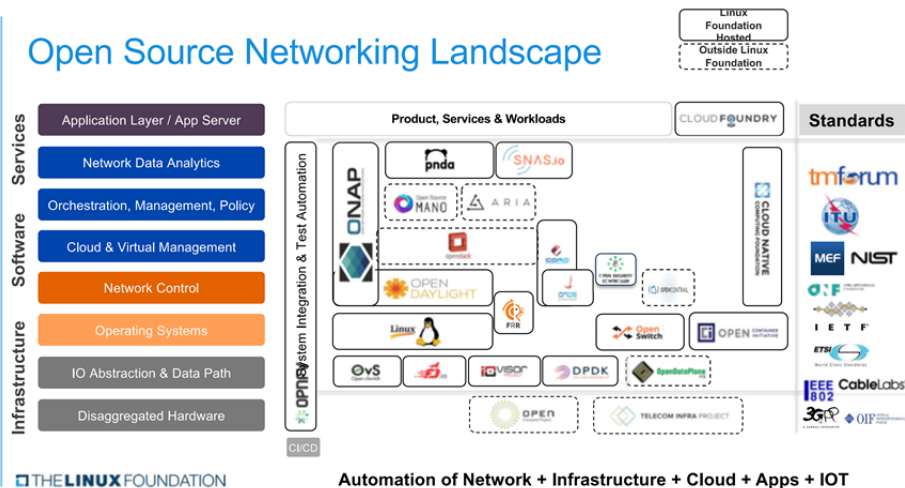
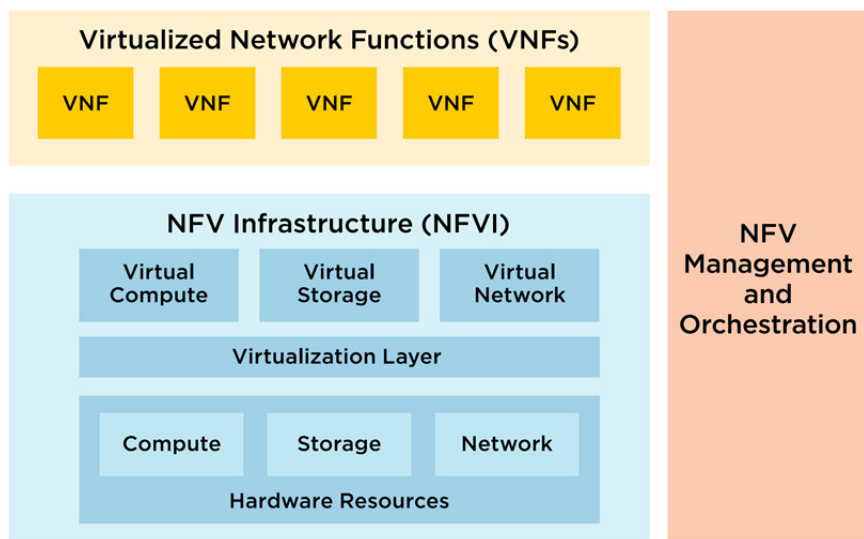
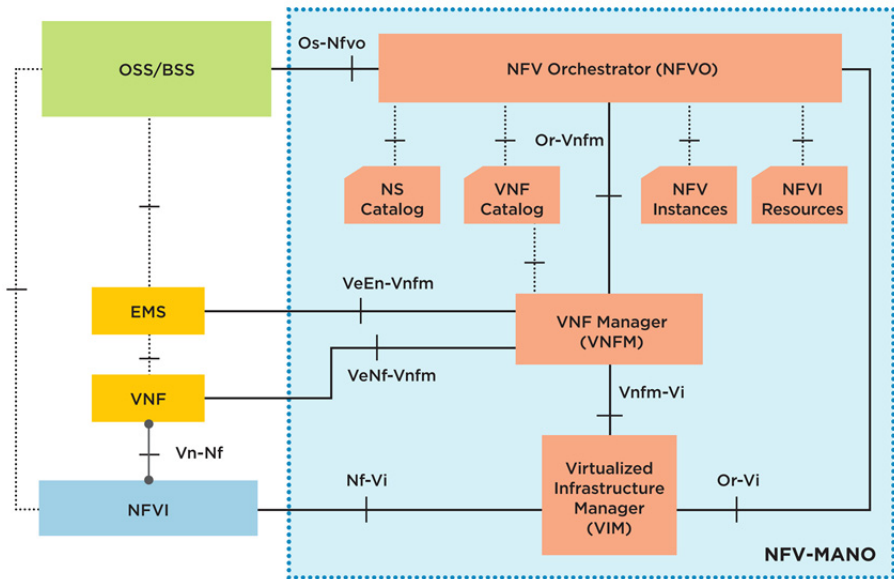


Figure 4.2. Range of open source software projects in the field of networks

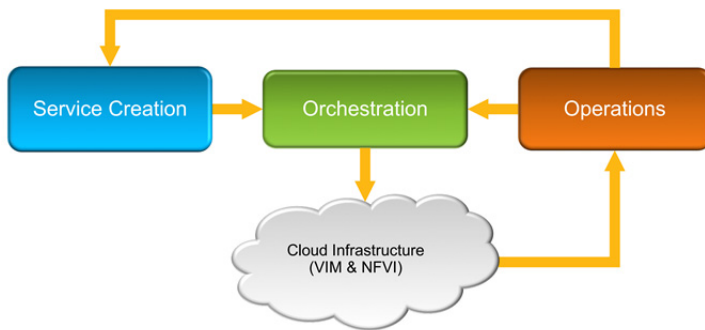


**Figure 4.4.** *Basic frame of the OPNFV platform*

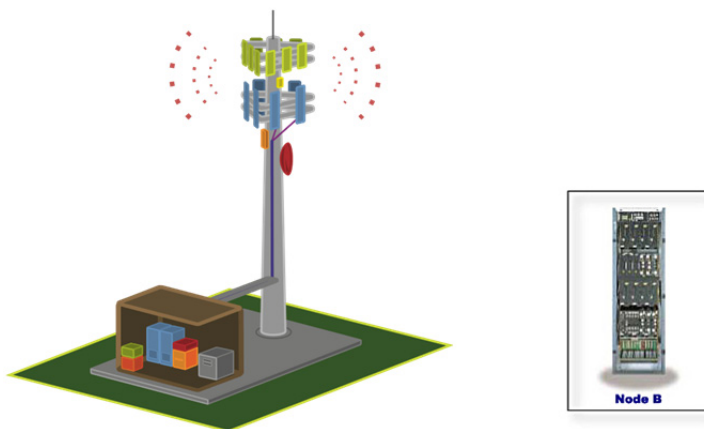


**Figure 4.5. Description of MANO**

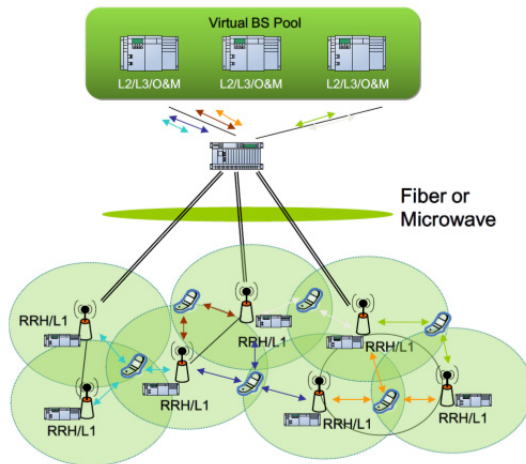




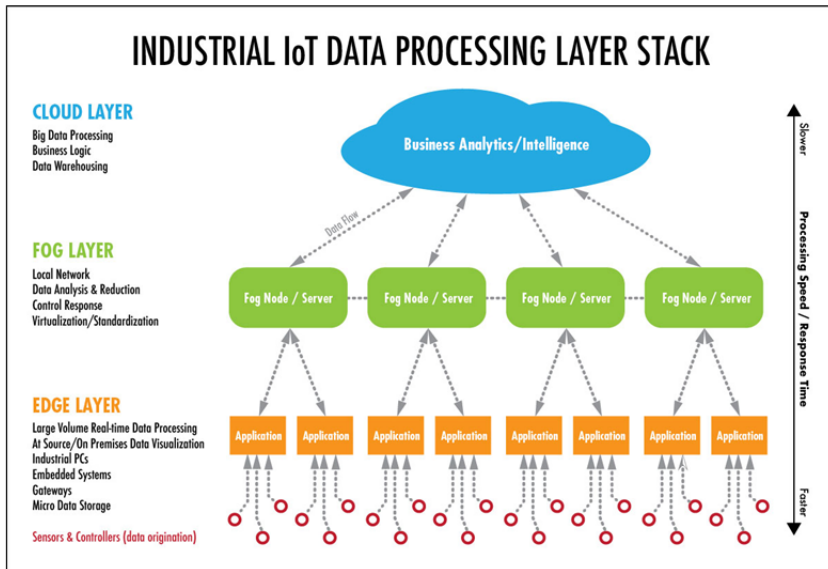
**Figure 4.13.** *The three ONAP sub-systems. VIM: Virtualized Infrastructure Manager. NFVI: Network Functions Virtualization Infrastructure*



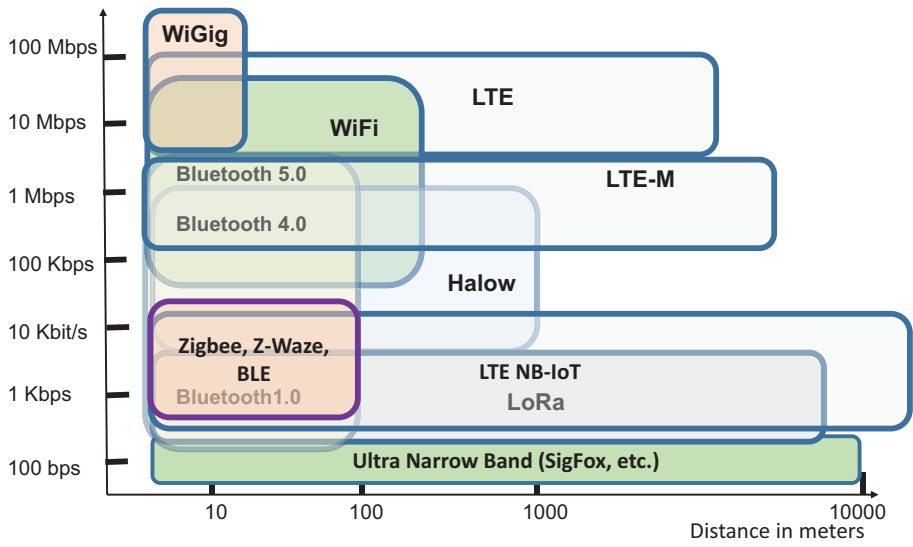
**Figure 5.2.** *eNodeB or gNodeB of an antenna of a network of mobiles*



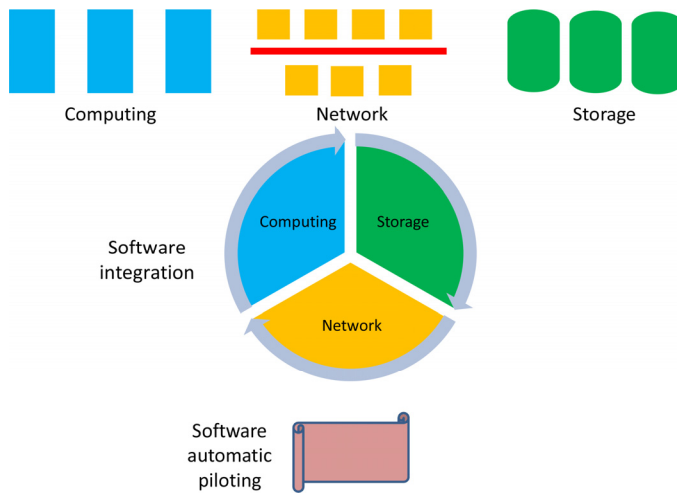
**Figure 5.7.** *C-RAN with an antenna-level distribution*



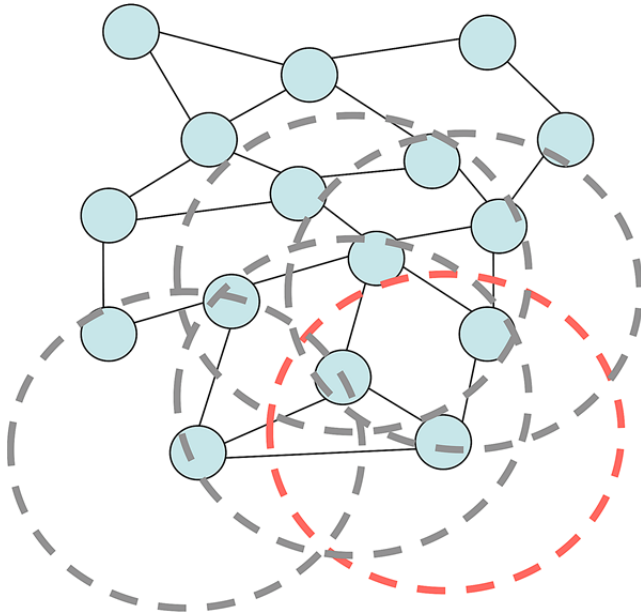
**Figure 6.4.** *Process of Industry 4.0*



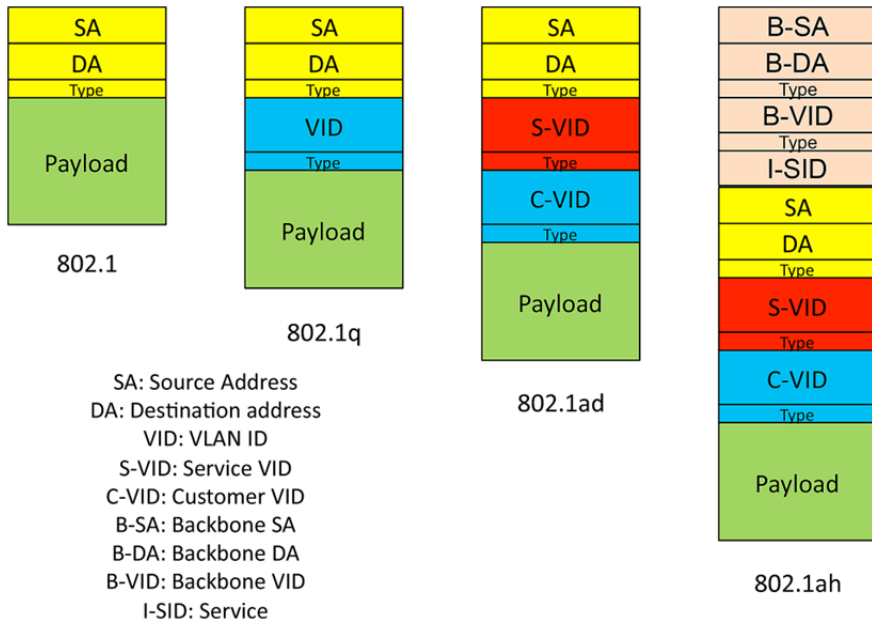
**Figure 6.8.** *Networks for the Internet of Things*



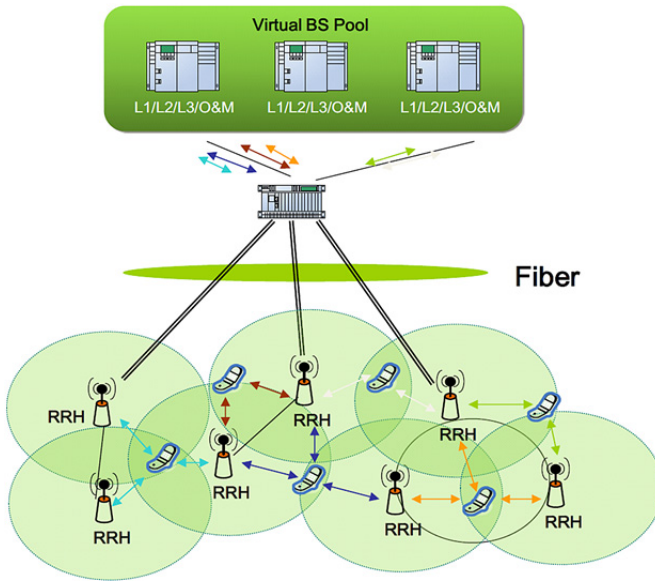
**Figure 8.1.** *Self-piloting system*



**Figure 8.8.** *One-hop situated view*

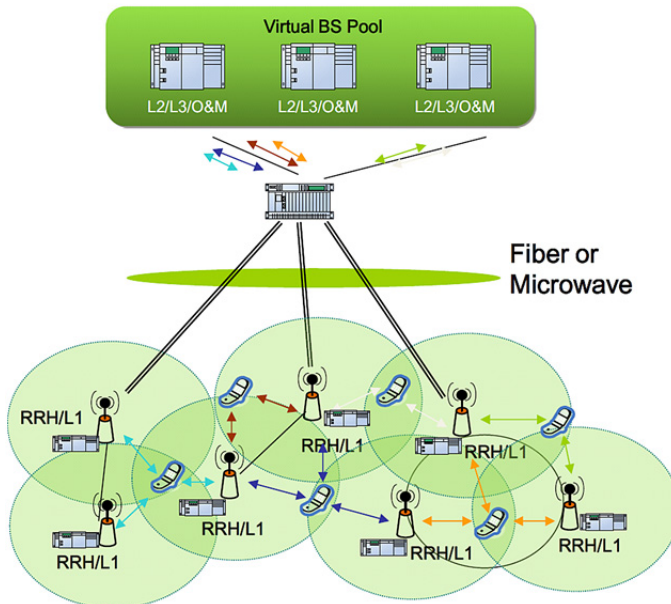


**Figure 9.11.** *The different versions of Carrier-Grade Ethernet*



**Figure 11.21.** *The fully centralized Cloud-RAN architecture*





**Figure 11.22.** *The partially distributed Cloud-RAN architecture*

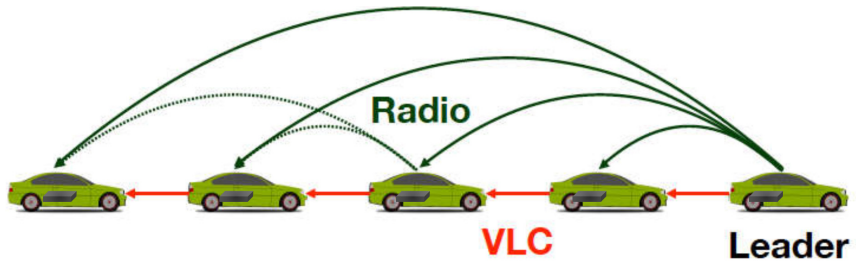


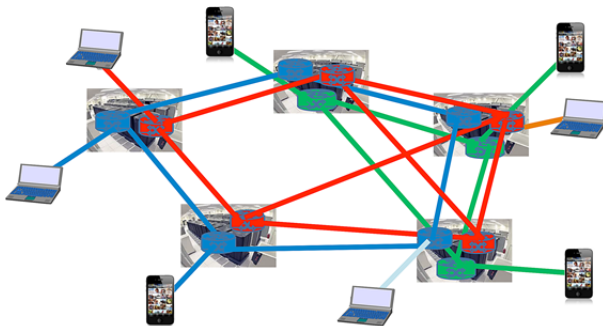
Figure 13.1. *Vehicle-to-Vehicle communication – V2V*



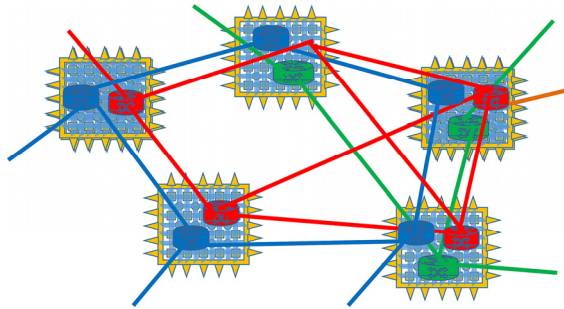
Figure 13.3. *Communication through light between vehicles*



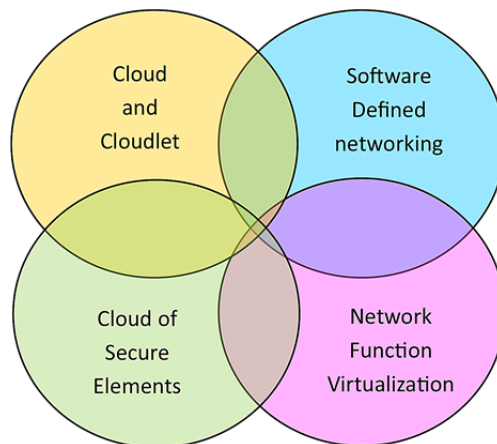
**Figure 15.5.** *A Cloud of secure elements*



**Figure 16.9.** *Software networks*



**Figure 16.10.** *Morphware network*



**Figure C.1.** *The fundamental elements of new generation networks (NGNs)*