

The Evolution of Mobile Communications and the Internet of Things

Luis M. Correia

Instituto Superior Técnico / INOV-INESC
University of Lisbon, Portugal

- A brief view into the past.
- Applications and the Internet of Things.
- Networks of the future.
- Conclusions.

Learning from PCs (1)

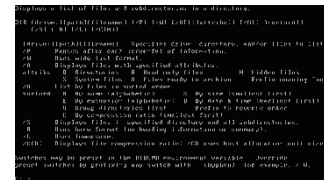
- Mainframes dominated, until PCs took over when computers were extended to the mass market.
- An operating system based on windows had a crucial importance in the spread of PCs.
- Easiness of use is essential for the mass market.



(IBM, 1972)



(Apple, 1986)



(Wikipedia, 1972)



(Microsoft, 2007)



(PhotosCom, 2008)



(Nokia, 2007)

Learning from PCs (2)

- Initially, PCs had performance metrics that were orders of magnitude below the current ones (ZX Spectrum, 1982, 3.5 MHz, 16 kB, 0 GB).
- There is a race in wireless systems between services made available to users and data rates made available by phones/networks.



(Sinclair, 1982)



(Nadine Meade, 2000)

Learning from Cars

- In the beginning, the goal was for faster cars.
- Then, cars evolved for increased comfort and safety of passengers.
- Nowadays, cars are being sold for energy efficiency.
- Speed is no longer important!



(T Ford, 1927)



(BMW, 1978)



(Lexus, 2008)

The History of Bathing

- In the beginning, bathing was seldom, in rivers, or similar ways.
- Then bathtubs made their way, for individual bathing, initially with no running water.
- These days, shower is taken daily, individually, by everyone.
- New hygiene references exist, water is taken for granted, wasted.



(thebathtubdiva, 2014)



(neptsdepths, 2014)



(hansgrohe, 2014)

Terminals (1)

- Terminals are varied, serving different usages and services:



(BigCircle, 2012)



(techclones, 2013)



(tomsguide, 2013)

Terminals (2)

- The terminal of tomorrow may be spectacles:
 - everyone will use one, like a wrist watch today;
 - they will carry your personal RF SIM, which will enable to use other devices, appropriate to other uses (in car, at home, in the air plane, at the office, etc.)



(Google/CNET, 2013)



(Minority Report, 2002)

Information Access

- The paperless society will have a huge impact on networks:
 - media will be consumed in portable devices;
 - daily commuters will need a lot of information on an instantaneous basis.



(Apple, 2010)



(musingsfrommedway, 2010)

Location Awareness

- Location based services are being introduced these days, upon user demand.
- The opposite way may be introduced, i.e., the environment being aware that the user is present.
- Are we in danger of having a situation similar to spam or virus on mobile phones?



(Unwired, 2007)



(Minority Report, 2002)



(SpamSy, 2008)

Internet of Things

- Today's systems are based on a person being the end user.
- Future systems must consider machine-to-machine communications as being, potentially, more important.
- Sensor networks are emerging as one of the “killer” network structures of the future.



(Kenwood, 2007)



(DHD, 1998)



(SensorProd, 2007)

Current Perspective

- Today's wireless systems are still very much used in the perspective of “one size fits all”.
- We're no longer in the era of voice centric networks, hence, service differentiation should be used.

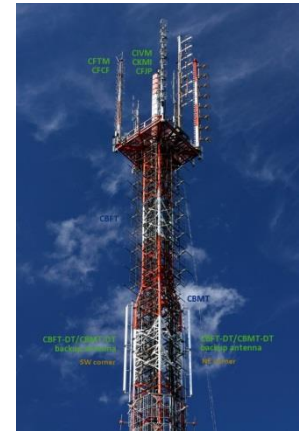


[AutomationClerc, 2013]

- Sharing of spectrum with other systems:



[*wikimedia*, 2013]



[*digitalhome*, 2013)]



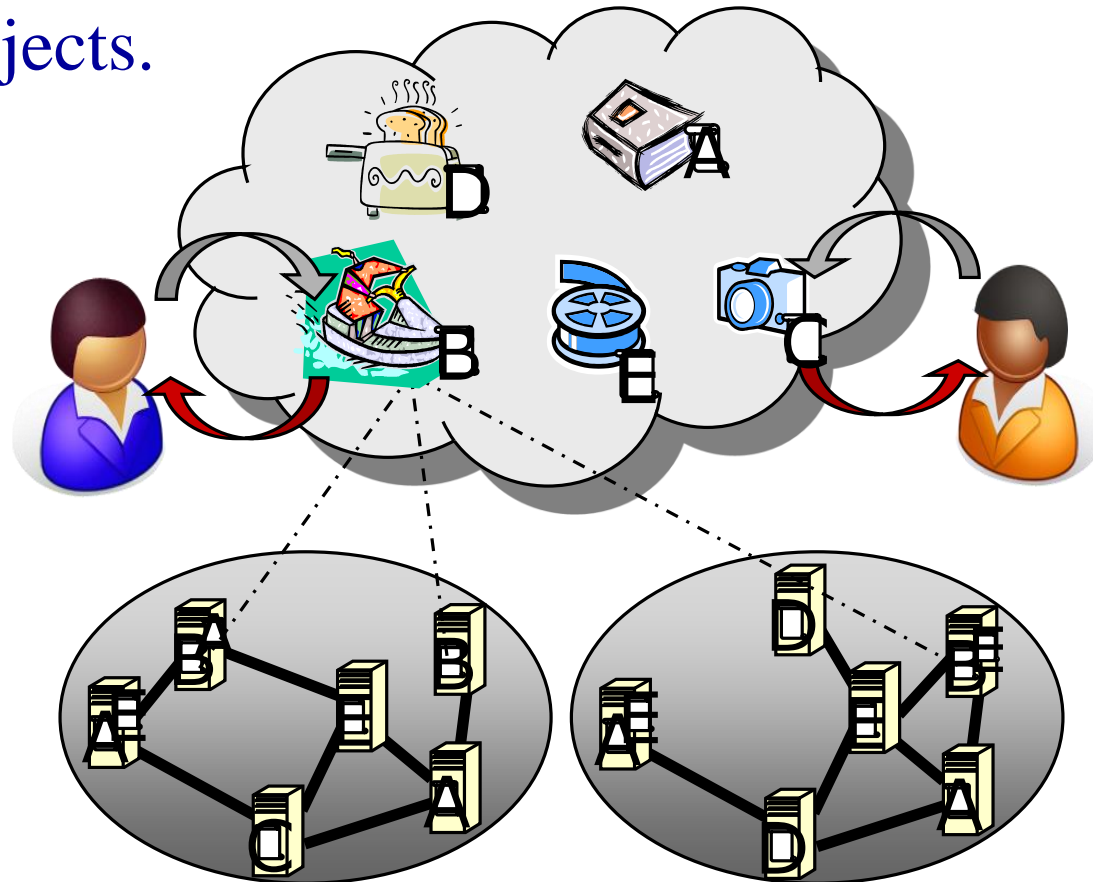
[*tripod*, 2013]



[*ECRV, 2013*]

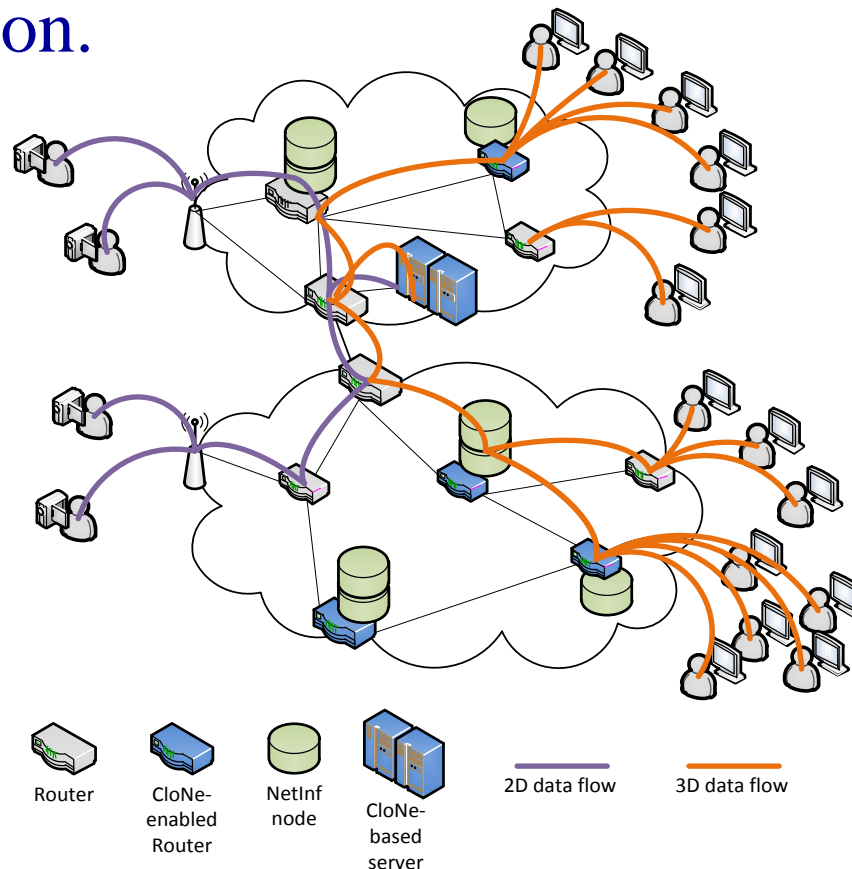
Network of Information

- Information centric networks will enable a new perspective to the delivery of information, based on objects.



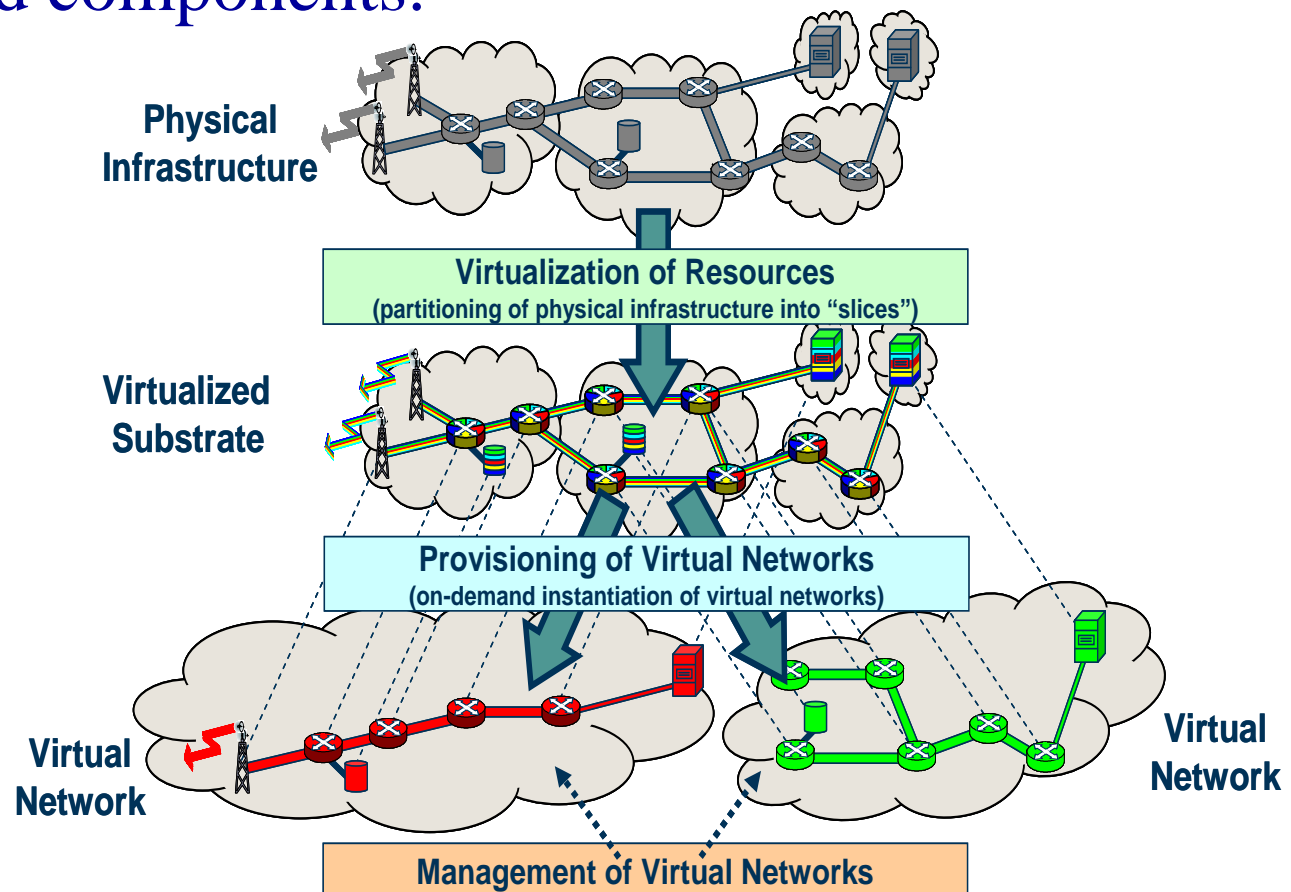
Cloud Networking

- Cloud computing and networking will provide a very efficient means to process and distribute information.



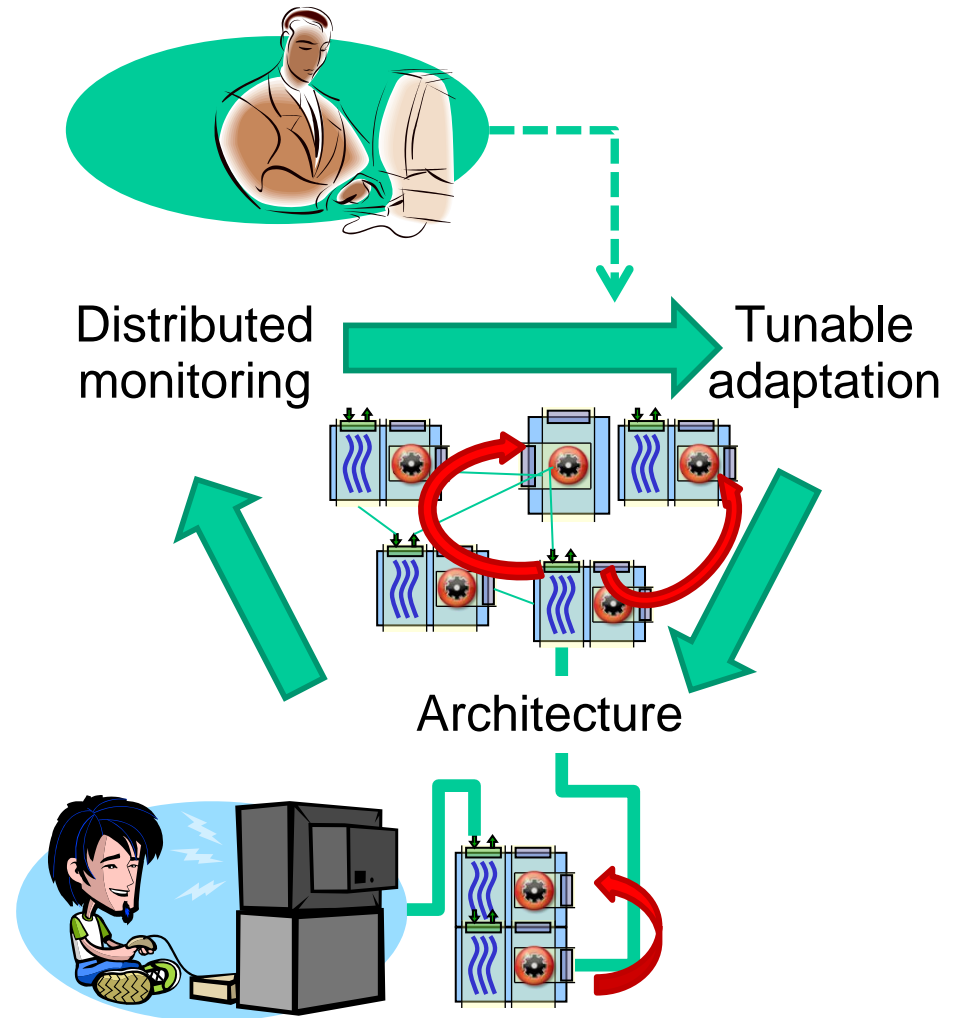
Network Virtualisation

- Networks will be virtualised at both the radio and fixed components.



In-Network Management

- Networks' will evolve to “self-management”, coping with complexity (bringing “plug-and-play” to networks).



Conclusions

- Technology development in the mobile and wireless communications is allowing for a “new world” in telecommunications.
- This area continues to present key challenges that need to be addressed in R&D, in order to have solutions for the problems of the future.
- The Internet of Things and Smart Cities appear as an excellent opportunity to integrate technologies, within and with other sectors.

**Thank you
for
your
Attention**



<http://grow.inov.pt>