
Virtualizing National Broadband Access Infrastructure

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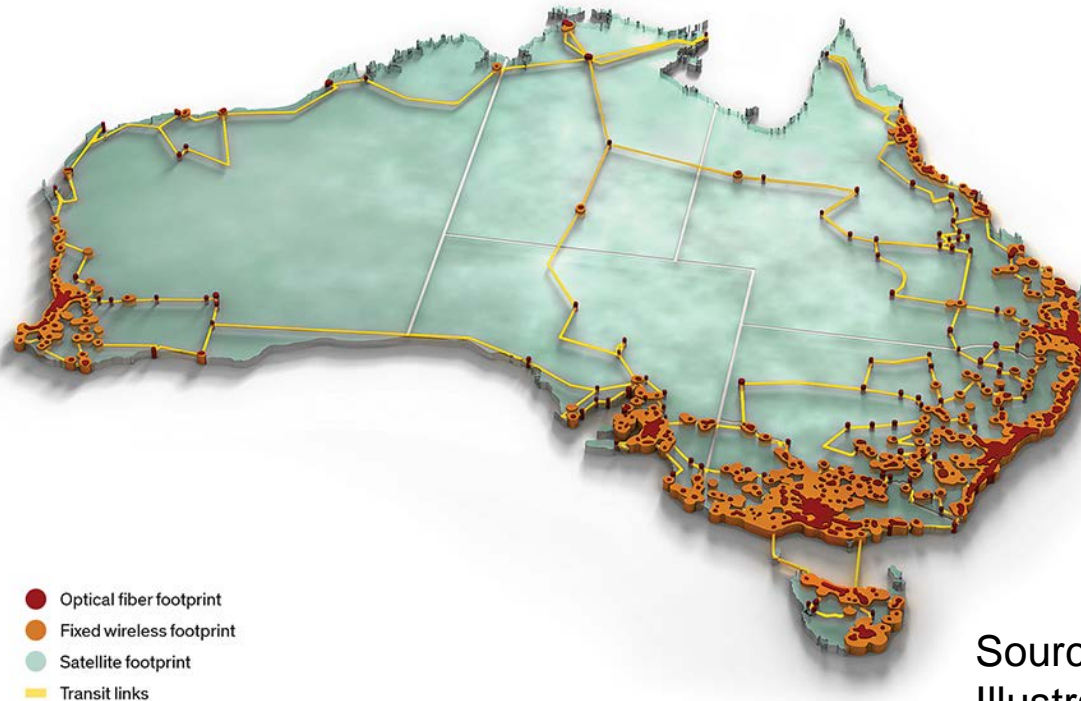
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Motivation: Public Access Networks

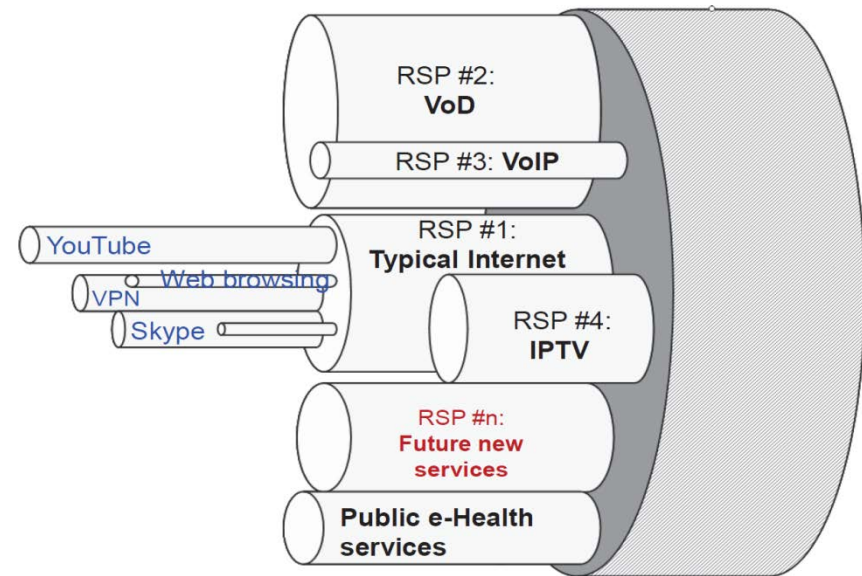
- Singapore, Japan, South Korea, New Zealand
- Australian NBN: ~\$45b
 - V. Sivaraman, Craig Russell, Iain B. Collings and Adam Radford, "Architecting a National Optical Fibre Open-Access Network: The Australian Challenge", IEEE Network Magazine, 26(4):4-10, Jul/Aug 2012.



Source: NBN Co.
Illustration: Emily Cooper

Opportunity

- Decoupling of infrastructure from service:
 - NBN provides wholesale connectivity via layer-2
 - Retailers compete to offer layer-3 services
- Enables virtualisation:
 - Multiple retailers (RSPs) per household
 - Specialised providers: video, gaming, voice, ...

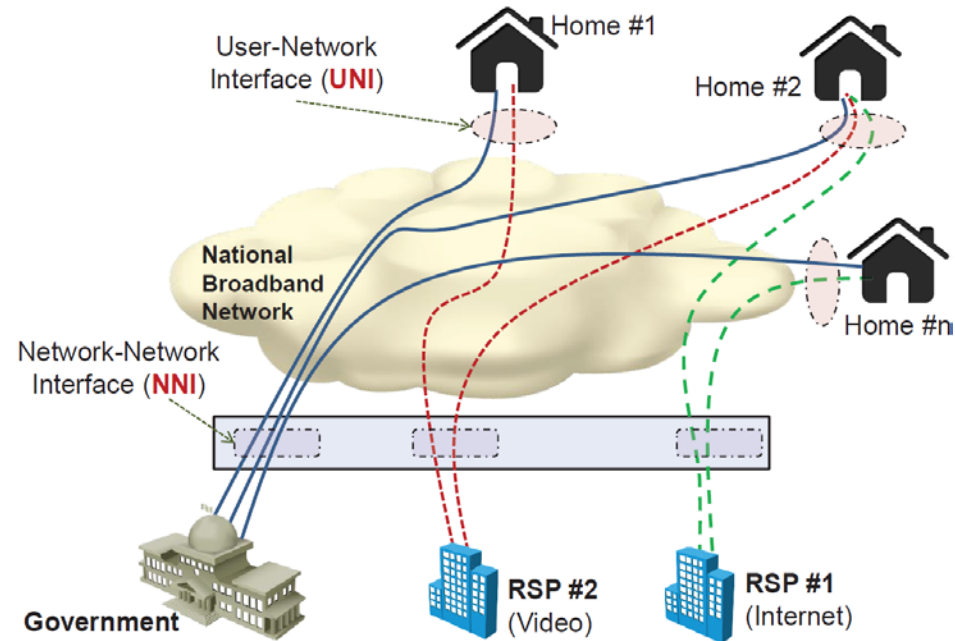


Benefits of Virtualization

- For RSPs:
 - Explicit control over service quality (assured “slice”)
 - Reduced need for (static) capacity planning
 - Pay-As-You-Go with on-demand provisioning
- For End-user:
 - Mix-and-match best-of-breed (streaming video, gaming, voice, ...)
 - Avail of niche services at lower “unbundled” cost
 - Can customise service quality per service
- For Infrastructure provider:
 - More efficient usage of network resources (on-demand provisioning)
 - “Unbundling” encourages greater competition in service offerings
 - Content Provider can become a niche RSP

Research Questions

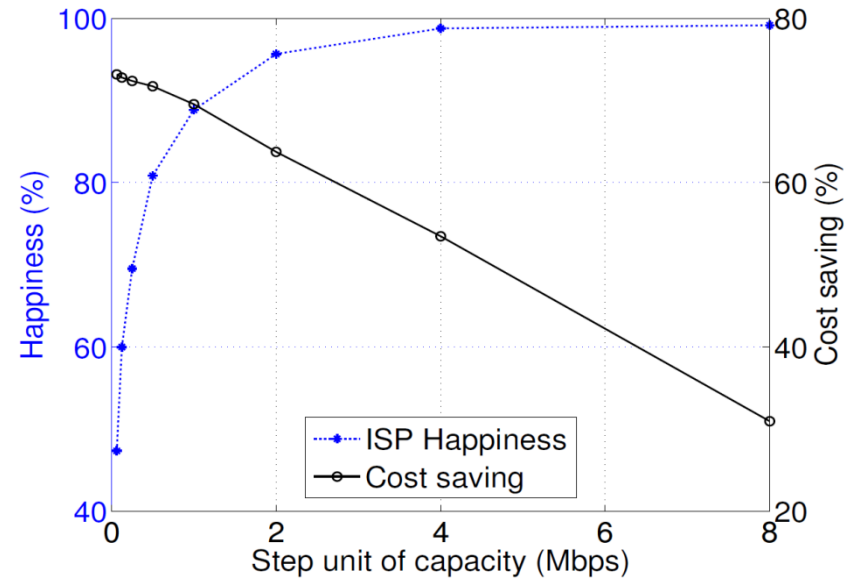
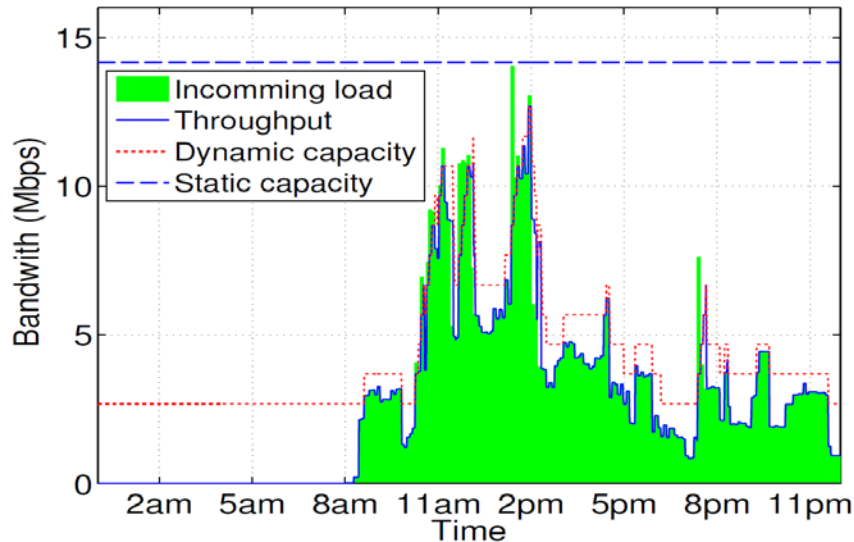
- SDN interfaces for virtualization?
 - Open: RSPs/users can control slices
 - Dynamic: time-scale (seconds, minutes)?
 - NNI interface:
 - Pricing model?
 - Quality capabilities: b/w, latency, loss, ...?
 - UNI interface:
 - Household device priorities, policies associations?



Simulation Study

- Trace data from university WiFi network
 - 30 houses, each has one AP
 - 10-15 active clients per house
 - 8500 user sessions in total (known duration and rate)
- 4 RSPs with market share 10%, 20%, 30%, 40%
 - client randomly assigned to an RSP
 - RSP provisioned with base capacity = average demand
 - NNI API to increase/decrease RSP bandwidth by discrete amount at 1-minute time-scale
- Metrics:
 - Fraction of “unhappy” user sessions
 - Cost saving for RSP

Results



- Dynamic bandwidth provisioning
 - Reduces RSP cost by 70%
 - While keeping 90% sessions happy
 - Time-scale and bandwidth granularity need tuning

Conclusions

- Public-funded access networks are emerging
- Opportunity for multiple service providers per household
- SDN technology can facilitate this virtualization
 - Interfaces need to be developed
 - Pricing models need to be investigated
 - Governments need to be informed