Containers for NFV

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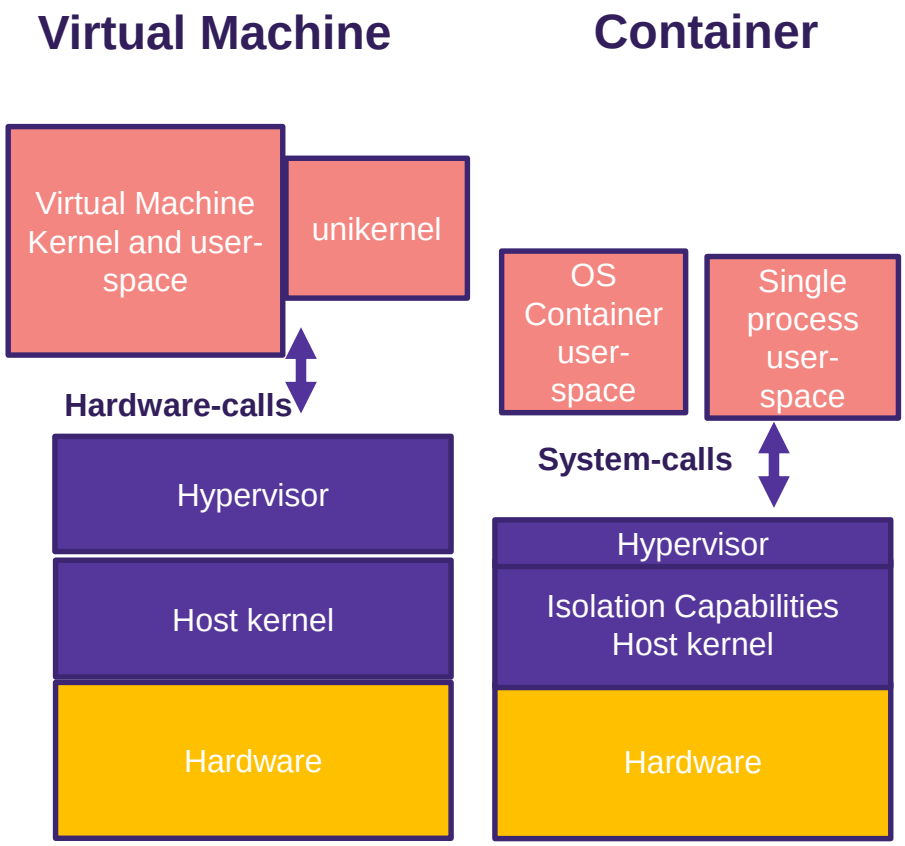
Containers

What

- Software constructs used to isolate components.
- Avoids hardware emulation of a virtual machine.
- Relies on namespaces & control groups for process isolation.
- Technology already having a significant impact in the cloud.

Why

- Greater portability leading to shorter development cycles.



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Fundamental Benefits

Comparing basic Linux VNFs using LXC Containers v. KVM VMs:

- Instantiate 8 times quicker: 50 seconds v. 7 minutes
- Spin-up 50 times quicker: 0.5s v 24s
- Consume 40 times less memory: 6MB v 256 MB
- Consume 8 time less disk: 512 MB v 4 GB
- 75 times more network throughput: 30 Gbps v 0.4 Gbps

Warning results will vary according to Linux versions and hardware etc. More importantly significant dependencies on what is included in the VNF build – more on this later.

See also “An Analysis of Lightweight Virtualization Technologies for NFV”
https://www.ietf.org/proceedings/96/slides/slides-96-nfvrg-3.pdf

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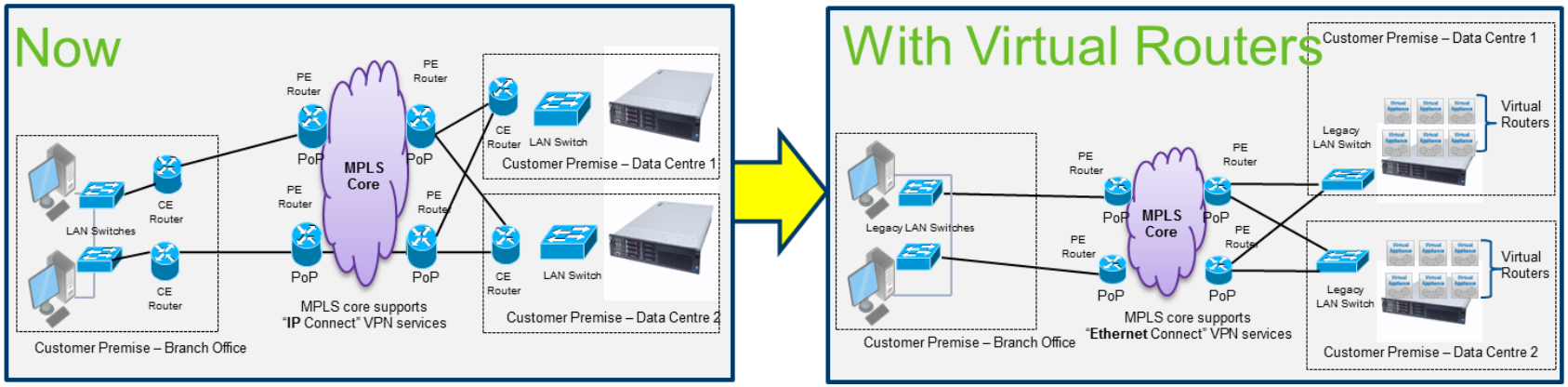
Use Case 1: Virtualising Branch Routers in the DC PoC



Benefits from Virtualising Branch Routers

- Increased service availability: > 600 hours/year in case study
- Quicker innovation & faster response to change requests through easy batching of configuration & software upgrades.
- Flexibility – adding new services

Issue with Virtualising Branch Routers

Isn't a multi-tenant router solution better?

- Is it easier to manage?
- Is it easier to develop new services?

Issues with using VMs:

- VM based V-router takes too many hardware resources –Tbyte RAM for 500 routers
- A full Linux system is large, and then the monolithic routers have more protocol and management functions than used.
- Slow to add in new branches or capabilities.
- Slow to boot hence duplication of virtual routers for protection.

The above issues will be fixed by using Containers instead of VMs.

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Use Case 2: Containers Synergy with 5G Network Slicing

- Allows efficient slicing and sharing of compute resources where may have many slices running functions built on the same operating system.
- More granular sharing of resources (especially vCPUs) than VMs.
- Allows faster re-sizing of resources per slice.

http://www.btplc.com/Innovation/Innovationnews/5Gnetwork/index.htm

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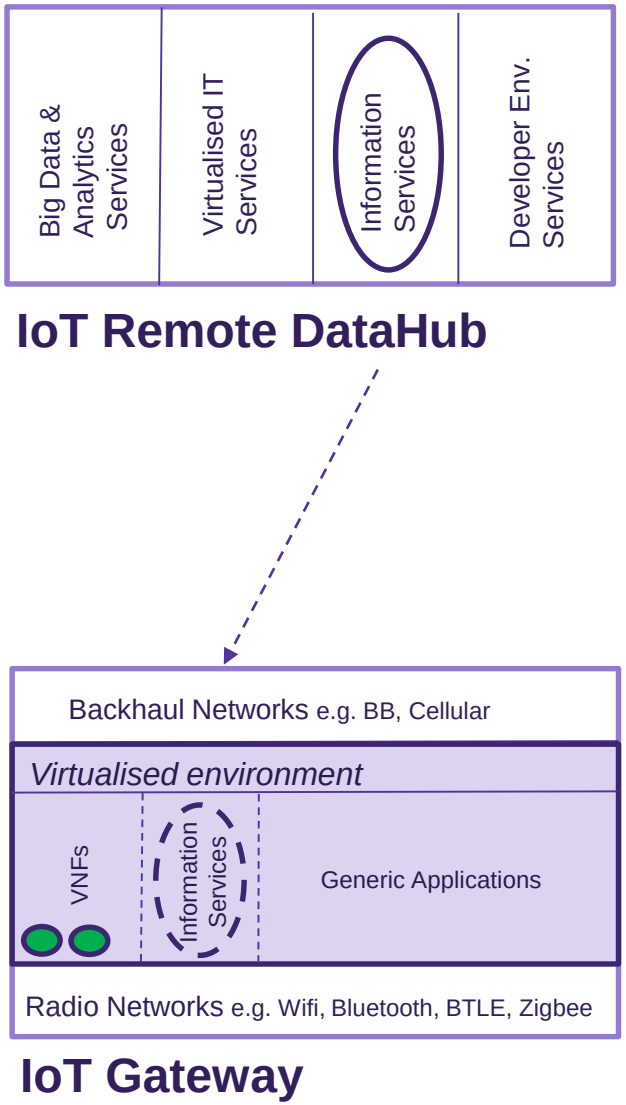
Use Case 3: Service Protection & Energy Saving

- It typically takes ~5 minutes to boot a VNF therefore we need hot VNFs on standby.
- Servers running at 0% load still consume ~30% of the power of a fully loaded server.
- If we can not over commit resources for hot standby VNFs then in the worst case we need twice as many servers are required, half on hot-standby, increases total power consumption by 30%.
  - 1:N protection schemes using load balancing improve this.
  - Still need 1:N for every type of VNF.
- The fast spin-up time of containers makes it feasible to do 1:N protection across all VNFs.
  - Need a much smaller number of unloaded servers on stand-by.

Use Case 4: At the edge/fog scenarios

- Not all NFV will be in the cloud
  - Edge networks often have limited upstream bandwidth so local processing gives best service quality, reduces latency & networking costs
  - Many users prefer the reassurance of a none-cloud solution
  - In some cases, this is a requirement for local security policies

- Factory, retail, office or home has local computing resources, such as an IOT gateway or simple residential BB gateway
  - Enable good use of these resources on a very cost sensitive market



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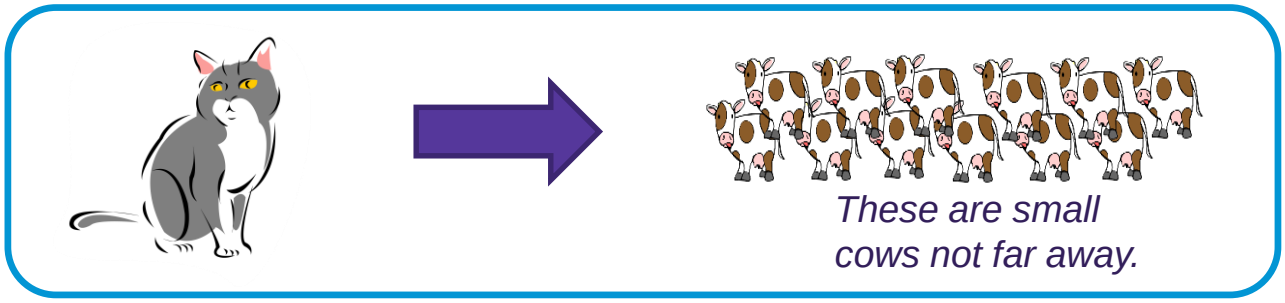
Challenges for the Industry with Containers for NFV

Containers for NFV could give Carriers and Vendors radical efficiency gains for compute, development & operational resources plus improved flexibility and responsiveness compared to VMs but several challenges have to be addressed:

1. Container management systems (CMS) need to natively support multiple network interfaces per container. (e.g. Multus)
2. VNFs need to be decomposed into micro-services to make best use of resources.
   - Microservices may make development easier but make operations more complex due to the increase in the number of exposed interfaces.
3. Carriers need to develop "NetDevOps" models to make best use of micro-services.
4. Security - VNFs & hosts must use best practice.
5. The business benefits of Containers for NFV needs to be quantified to drive this innovation.



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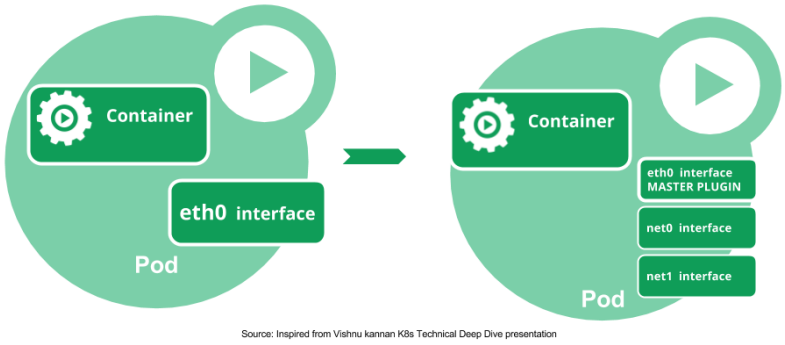
Progress & Next Steps

- Rapidly developing technology e.g: Multus Dec 2016, Dec Rkt 2014, K8 Jun 2014.
- Multus Container Network Interface adds a plugin to Kubernetes to support multiple isolated network interfaces per pod. https://github.com/Intel-Corp/multus-cni
- Research on stateless VNFs.
- Quantify the benefits to encourage vendors to create containerised VNFs and network operators to address the network DevOps challenges.



Source: Inspired from Vishnu kannan K8s Technical Deep Dive presentation

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Bringing it all together