Virtual Networks RG
IAB Review

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IETF-78, Maastricht, NL

Point of Departure…

- Concurrent use of single infrastructure for multiple network instances
  - Subnets, e.g., VLANs
  - Links, e.g., Tunnels in the Internet
  - Routers, e.g., virtual routers
- VN technology widely used in IP-based networks
  - lack of common understanding of impact & usage
  - VNs are specific to system
- Challenges:
  - incompatible or competing network techniques
  - varying focus – subnets, transit backbones (VPNs), links/routers
  - host network issues are left out completely
  - focus on testbeds (e.g. GENI) or closed systems (e.g. data centers)
  - tons of existing techniques available, but limitations, uses not clear
- Too many disjoint and non-interoperable VN uses

The VNRG

- Meeting point to progress VN field
  - forum for VNs researchers
  - considering today's Internet and beyond
- Identify architectural challenges
  - integration, not just technique X in special case Y
  - implications for control, management, and security planes
  - implications for the future: identify emerging technological and implementation issues
- Catalyze a common understanding
  - what issues are VNs addressing
  - how are they addressing the issues
  - which existing technologies can be more widely used/applied
  - is there a need to change/fix/invent a technology

Charter

- A recent trend in networking is the concurrent use of a single physical network for multiple variants or instances of networks, e.g., IPv4 and some experimental protocol suite, or VLANs. These networks, called Virtual Networks, provide isolation between network instances or types and support shared use of the same infrastructure for different purposes.
- Virtual networks attempt to better utilize networking infrastructure by reusing individual routers or links (i.e., either physical or logical networking resource) for multiple concurrent network instances, or to aggregate multiple such resources to obtain increased capabilities. These resources can be any network component, including routers, hosts, links, and services, (e.g., name mapping services). Increased capability can refer to aggregate capacity provided by bundles of links or groups of routers, or increased fault tolerance of a cluster of primary and backup service systems.
- Important properties of Virtual Networks (VNs) are i) that each resource can be used concurrently by multiple VN instances, ii) the clear isolation of any VN from all others, and iii) abstraction, in which a given virtual resource (host, link, router, service) need not directly correspond to its component resources. These properties need to be supported down to each physical component, such that each router, host, and link supports concurrence, isolation, and abstraction.
- In the network community, “Virtual Networks” is a very broad term, including running multiple wavelengths over a fiber, MPLS, virtual routers, and overlay systems. VN technologies are widely used in parts of the Internet and other IP-based networks, but the community lacks a common understanding of the impact of virtualized networks on IP networking, or how VNs are best utilized. As a result, virtualization has been difficult to integrate across various systems, such as network operators, vendors, service providers and testbed providers (e.g. GENI, FEDERICA, etc).
- One current challenge with existing VN systems is the development of incompatible or competing networking techniques in the Internet, causing deployment issues in the future (or even now). For instance, there are numerous ways to virtualize routers and their internal resources (e.g., multiple, isolated routing and forwarding tables) and to virtualize core networks (e.g. MPLS, LISP), but the end host virtualization has not been addressed (e.g., beyond the need for virtual interfaces). Few virtual network systems allow a particular virtual machine in an end host to control its attachment to a specific private network. End host virtualization architecture also determines whether virtualization is per virtual machine, per process, or per connection – and this difference can determine exactly how the end host can participate in VNs. Similar issues arise for virtual services, virtual links, etc.
- This RG builds on the efforts of a number of IETF WGs, including encapsulated subnets (LISP at layer 3, TRILL at layer 2), subnet virtualization (PPVPN, L3VPN, L2VPN, PPVPN), and aspects of managing virtual components (VRRP), as well as some work in more general areas, notably on tunnels (INTAREA). A side effect of this WG is to help place these contributions in a broader context.
- The VNRG will consider the whole system of a VN and not only single components or a limited set of components; we will identify architectural challenges resulting from VNs, addressing network management of VNs, and exploring emerging technological and implementation issues.

Related IETF Activities

- Encapsulated subnets
  - LISP at L3
  - TRILL at L2
- Subnet or network subset virtualization
  - PPVPN
  - L3VPN
  - L2VPN
- Managing virtual components
  - VRRP, FORCES
- Tunnels in general
  - INTAREA, SOFTWIRE

Relationship to existing WGs

- Current WGs focus on component solutions
  - Router virtualization – VRRP, FORCES, LISP(?)
  - Link virtualization – INTAREA, SOFTWIRE, etc.
  - Partial VNs – PPVPN, L2VPN, L3VPN, LISP/TRILL
- Need comprehensive arch. work
  - At first, the virtual version of INTAREA
    - Focus on the complete E2E network and its components
  - In a way, a virtual version of INT/RTG/OPS etc.
    - Impact of virtualization on the entire IETF/IRTF
  - VNRG as a way to coordinate this effort

Active Players

- Most active players in past weeks
  - Oracle/Sun, US
  - University of Gent, BE
  - ETRI, KR
  - University of Karlsruhe, DE
  - ISI, US
  - NEC, DE
  - Alcatel-Lucent, FR
- Other past active players
  - Huawei, US
  - Telefonica I+D, ES
  - AKARI, JP group
  - 4WARD, EU group
  - GENI, US group

Other targeted participants

- Future Internet members
  - KAIST, KR
  - NSF FIND/FIA members
- Issue-based members:
  - DTNRG (disconnected VNs)
  - NAT
  - Transition technologies

Past RG work

- BOFs
  - IETF 71 Mar 2008 Philadelphia
    - “Test the waters”
  - IETF 73 Nov 2008 Minneapolis
    - First full BOF
    - Recognized router virtualization; focus on net and host issues
  - IETF 75 Jul 2009 Stockholm
    - Coordination/alignment
    - OS vs. network virtualization debate -> focus on network (NV->VN)
  - IETF 76 Nov 2009 Hiroshima
    - “Lite” charter finalization
    - Placeholder (BOF held as an informal pre-RG meeting), include additional Asia partic.
- First RG meeting IETF 77

- CURRENT GOAL:
  - transition from ‘write only’ presentations to interactive collaboration

Current VNRG Status

- 1st RG meeting during IETF-77 (Anaheim)
  - conference style presentations
  - few discussions
  - but a good number of attendees (~80)
- Light discussion on mailing list between IETF-77 and now
  - Continuing to unify perspective from BOF discussions:
    - "OS" vs. "net" focus (currently net focused)
    - testbed vs. regular operations
  - initial Problem Statement got wedged too early on wordsmithing
    - currently revising to group-edit the outline/issues, etc.
    - finding/discussing the problems first
- 2nd RG meeting here at IETF-78
  - Key issue to be addressed – "virtual" vs. "logical"
- 272 subscribed to mailing list (as of 07/23)

VNRG@IETF-78

- Workshop style
  - fewer presentations (4 in total)
  - short presentations on key unifying issues
    - focus on ‘virtual’ vs. ‘logical’
  - time for open discussion
- Lively discussions – 77 attendees
  - federation
  - virtual vs. layering
  - VN vs. VLAN vs. VPN
  - provisioning
  - control & management vs. data plane virtualization
  - go & no go tests
- First drafts out of this ready for IETF-79
  - initial background and terminology issues
  - uses cases

Products/Output

- Focus:
  - ***unifying terminology and concepts***
- Initial set of work items (from charter):
  - concepts/background/terminology
  - common parts of VN architectures
  - common problems/challenges in VN
  - descriptions of appropriate uses
  - some solutions (per-problem perhaps)
- The RG will initially focus on VNs but at a later stage the RG will also be open to related topics, such as system virtualization.

Architectural Implications

- The entire focus of the RG!
  - implications on each others VN architectures
  - implications on current Internet architecture
  - implications for transitional mechanisms
- Key aspects
  - multihoming
  - mobility
  - multipath
  - router/host virtualization
  - tunneling
  - network management
  - interaction between provisioning and NM/routing

Conclusions

- RG charter captures current and near term situation well
  - RG expected to move with a slow pace initially
  - diverse set of players with diverse perspectives
- RG's charter vs. RG's reality
  - lots of energy, but community is quite clustered
  - investing now to get a common, unified view
  - later focus on the challenges and key issues

Supplemental Slides

VNRG Materials

- charter: http://irtf.org/charter?gtype=rg&group=vnrg
- mailing list: http://www.irtf.org/mailman/listinfo/vnrg
- wiki: http://trac.tools.ietf.org/group/irtf/trac/wiki/vnrg