Les nouveaux enjeux du routage inter-domaine

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Objective of this presentation

- R&E community requires more network services than only any-to-any connectivity (Internet commodity)
  - Guaranteed bandwidth on Demand, Multicast, IPv6, VPNs, etc…
- End-users are rarely connected to one single network managed by a unique operator

How can we provide end-to-end services ?

How can we dynamically enable network resource for a given user and application ?
Agenda

1. Current Inter-domain situation
   - Internet

2. Evolution of inter-domain networking protocols
   - Some interesting IETF work

3. What is missing
   - Towards a new “business” layer

1- Current inter-domain situation
Internet is fundamentally Inter-domain. Research & Education Nets even more

- Inter-domain started with BGP, which was designed to support few thousand classful IPv4 routes
- Today the full routing table size is > 170000 routes
- With VPN services, more states must be maintained
- Today a carrier-class system can easily manage 1000000 routes in the forwarding table
  - Apart the number of routes, scalability of a network depends on the number of events to be processed by each node
- BGP introduced many features to extend the limits
  - Confederations, Route Reflectors, Multiple Planes, Outbound Route Advertisements, Route Target Filtering
- Today, inter-domain is **and only is** BGP
  - (+ MSDP for inter-domain IPv4 PIM SM)

Current Limit of Internet Technologies

- Internet proved its any-to-any connectivity capability
  - But it is just a connectivity service...

- Today Public Network requires
  - Any-to-any Multi-services capability
  - Which means:
    - Inter-domain QoS, Security and Reliability
    - And Dynamic Service activation
  - Requires new peering capabilities and techniques
    - It is not anymore just a question of exchanging route information
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Examples of Recent Inter-domain Initiatives in the IETF (1)

- Flow Specification Disseminations (or Dynamic firewall filtering)
  • draft-marques-idr-flow-spec
  • Mailing list:
    • http://www.cqr.org/mailman/listinfo/flow-spec

- End to end Inter-domain Multicast with AMT
  • draft-ietf-mboned-auto-multicast
  • BSD-based gateway and relay available today
    • Open source project funded by Juniper
    • http://www.mountain2sea.com/amt/
Examples of Recent Inter-domain Initiatives in the IETF (2)

- Inter-domain MPLS VPNs and Multicast VPN
  - draft-raggarwa-l3vpn-2547-mvpn

- Inter-domain GMPLS Traffic Engineering
  - draft-ietf-ccamp-inter-domain-rsvp-te
  - draft-vasseur-ccamp-inter-domain-pd-path-comp

Example: Schedulable Deterministic End to End Pipes

- For GRID projects, eVLBI, DEISA, MUPBED, HEC Facilities, CERN, EGEE etc…
- Potentially based on Layer 1, 2 or 3 technologies
GMPLS TE is originally intra-domain (RSVP-TE with routing IGP TE extensions)
- Inter-domain GMPLS TE extends signaling and routing protocols to set-up an LSP across multiple providers
- Need for proper policing and filtering of RSVP-TE messages at NREN boundaries
  - Filter/modify QoS parameters
- Need for scheduling
- In this example the Path Computation is performed per domain (route expansion)
  - Need for Provider-chain selection based on NRENs business relationship

Example: Schedulable Deterministic End to End Pipes
- For GRID projects, eVLBI, DEISA, MUPBED, HEC Facilities, CERN, EGEE etc…
- Potentially based on Layer 1, 2 or 3 technologies
- Need for a Capacity Management Middleware
  - Already several initiatives in R&E
    - However some challenges: Licences, network technologies required, standard used, multi-domain support, features/flexibility, security mechanisms, integration with other tools, vendor dependency

- Question: How can we converge to a common tool supported both by the global R&E community and the industries?
Napkins approach

- Wish List:
  - Ubiquity
    - Limited users, but can be anywhere so it requires any-to-any capabilities, potentially
  - Technology independent
  - Platform/Vendor independent
  - Domain independent
  - Perennial
  - Federative
  - Why not solving all “on-demand” type of network service at one stroke? Is there a common framework possible?
  - Prefigure future public networks

The realistic solution is in a Divide and Conquer approach, again never reinventing the wheel
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The need for a “Business Layer”

*What is an IPsphere?*

- A pan-service framework
- Defined by the IPsphere Forum
- Leveraging Service Oriented Architecture (SOA)
- Providing business structure for IPservices
Did they have NRENs and GRIDs use case in mind?

- … hmmm …
- But IPsphere offers:
  - A common framework for unlimited use cases
  - Based on standard protocols and technologies
  - No overlap with other standardization bodies: very focused on the business layer for a seamless integration
    - Network Technology independent
    - Network Management independent
    - Platform/Vendor independent
    - Service delivery is Domain independent
  - A standardized model, with a strong motivation to be quickly deployed in live networks
    - Involves the whole industry: many SPs, manufacturers, OSS, application vendors

A model for IPspheres

The IPsphere Forum defines an IPsphere as a network comprised of three basic "strata"
Today’s networks

The IPsphere Reference Architecture

Today’s IP networks reside in the lower two strata

- SSS
- NP&C
- TH

e.g. NMS, OSS, policy servers

e.g. SDH, Routers, firewalls, etc.

What’s different about an IPsphere?

The IPsphere Reference Architecture

IPspheres add a Service Structuring Stratum which leverages Service Oriented Architectures (SOA): "no need to reinvent the wheel"

The SSS allows networks to “publish” their service capabilities
Why is this so important?

The SOA framework - using mechanisms like SOAP, XML, UDDI - allows IP networks to "publish" their service capabilities into a structured operational framework.

"Hey, I can offer services X, Y, and Z!"
"Well, I can offer Y and Z, but no X!"
"Just Z for me!"

The creation of a true “business layer”

The Service Structuring Stratum provides this framework - allowing service capabilities to be joined together in unprecedented ways.

"Hey, I can offer services X, Y, and Z!"
"Well, I can offer Y and Z, but no X!"
"Just Z for me!"
Notion of Federations

1. All clients start behind a "Trust Barrier": akin to being 'in the lobby'
2. To get inside clients present credentials, and receive authorizing "token": akin to a 'badge'
3. "Federate" other clients participating in the activity: akin to populating the 'meeting room'
4. Provide network environment for the exchange - akin to 'projector, whiteboard, audio...

How SSS Messages Influence the Network

There are several models for service creation based on how partner providers connect:
- Facility Connect: Permissive (Internet-like) connection
- Policy Connect: Signalling through the ICI is policy-mediated
- Service Connect: Provisioned services explicitly linked at the ICI (NMS provisioning)
IPsphere Forum Membership

- Alcatel
- America Online
- Bezeq
- Brasil Telecom
- Brighthaul
- BT
- Cellcom
- China Unicom
- CIMI Corporation
- Cisco Systems
- Colubris Networks
- Datapower
- Ericsson
- fmc.service
- France Telecom
- GeoTrust
- Huawei
- Hewlett Packard
- IBM
- Internet 2
- Juniper Networks
- Korea Telecom
- Level 3
- Lucent Technologies
- Masergy
- Nexagent
- NexTone
- Oracle
- Packeteer
- Polycom
- Qwest
- Red Zinc
- Siemens
- T-Com
- Time Warner Telecom
- T-Systems
- Telenor
- Tellabs
- Telstra
- Telstra
- Ulticom

What IPsphere Is…and Isn’t

- IPsphere is a model for framing network services into a business context by linking service creation with service ordering and fulfillment.

- The IPsphere is based on SOA/WS principles for the exchange of business information, making it easy for it to manage the elements of higher-layer services that require identity management and reliable communications, including grid computing and ASP services.

- The IPsphere is not a strategy to create actual services within the network, provide QoS, or manage resources at the physical level. It is compatible with current & emerging standards, and the IPSF will work to ensure it stays that way.

- The IPsphere is not an alternative to the Internet, it is an alternative to the classical “Internet” business framework being applied to non-Internet services.
Conclusion

- Deploying a **Inter-domain Services** requires:
  - Both a vertical and horizontal approach
  - A synergy between NREN, end-users (e.g. GRIDs communities), but also with industries
- The problem can be addressed from different angles: but practical development and standardization work should be conducted together
- The winning solution will be federative, vendor and domain independent, simple to adapt to any current or future infrastructures and technologies
- The top model will not solve specifically one network service
  - A common framework for all “on-demand” network services
  - Overview: [http://www.ipsphereforum.org/newsevents/07nollereprint.pdf](http://www.ipsphereforum.org/newsevents/07nollereprint.pdf)

Thank You!