

# Les nouveaux enjeux du routage inter-domaine

Jean-Marc Uzé

JRES 2005

Marseille, December 5-9, 2005



## 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 ?

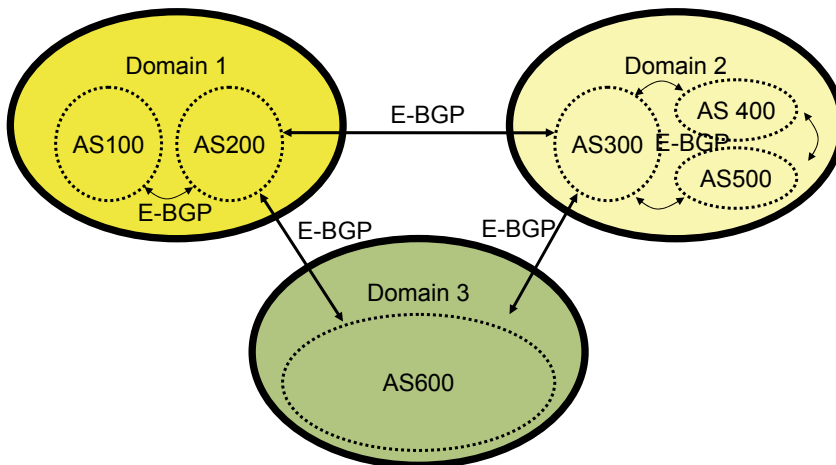
How can we dynamically enable network resource for a given user and application ?



# 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

# 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

## 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)

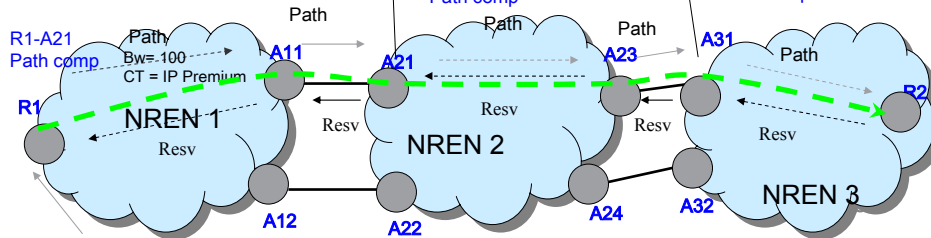
- Inter-domain MPLS VPNs and Multicast VPN
  - draft-raggarwa-l3vpn-2547-mvpn
- Inter-domain GMPLS Traffic Engineering
  - draft-ietf-ccamp-inter-domain-rsvp-te
  - draft-vasseur-ccamp-inter-domain-pd-path-comp

## 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

## Potential implementation with IETF inter-domain GMPLS TE

What is missing ?



Inter-AS TE-LSP R1-R2 : bw = 100m, CT = IP Premium

ASBR-Path: A21-A31-R2

- 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?



# 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

## The need for a “Business Layer”



*What is an IPsphere ?*

A pan-service framework

Defined by the IPsphere Forum

Leveraging Service Oriented Architecture (SOA)

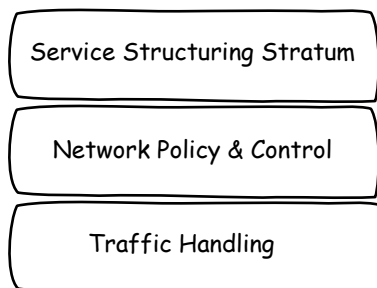
Providing **business structure** for IPservices

## 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 IPospheres

### The IPsphere Reference Architecture

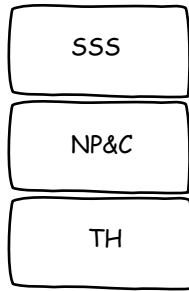


The IPsphere Forum defines an IPsphere as a network comprised of three basic "strata"



# Today's networks

## The IPsphere Reference Architecture



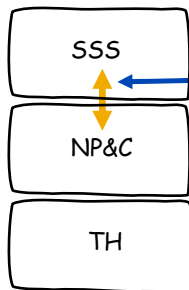
Today's IP networks reside in the lower two strata

e.g. NMS, OSS, policy servers

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

# What's different about an IPsphere?

## The IPsphere Reference Architecture

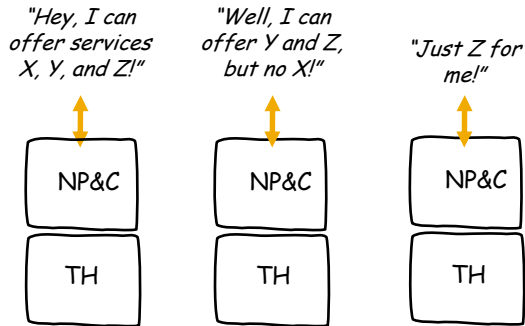


IPspheres add a Service Structuring Stratum which leverages Service Oriented Architectures (SOA): "no need to reinvent the wheel"

The SSS allows networks to "publish" their service capabilities

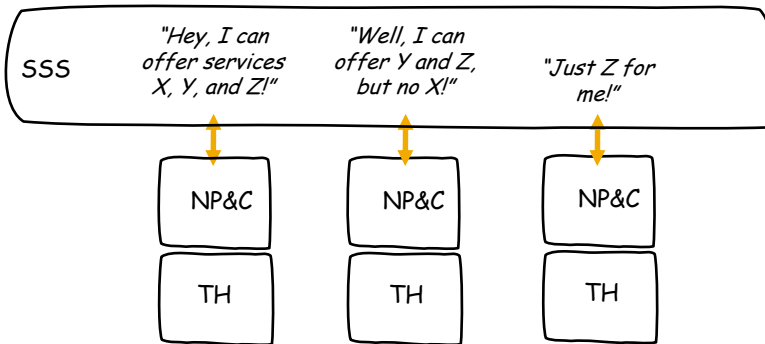
# Why is this so important?

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

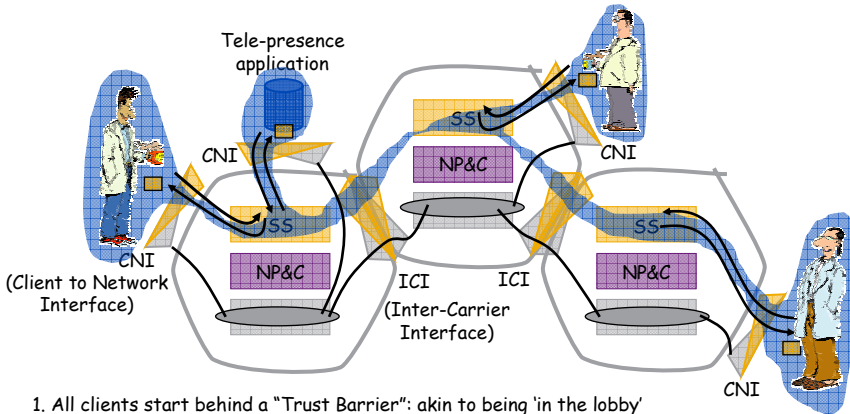


# The creation of a true "business layer"

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

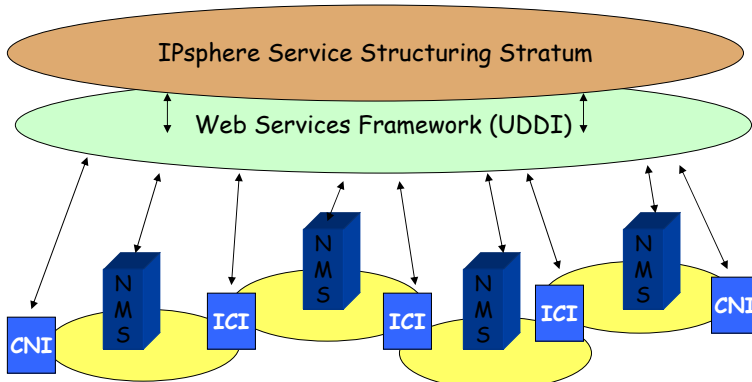


# Notion of Federations



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
- Brighthouse
- 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
- 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
- IPSphere Forum: <http://www.ipsphere.org/>
  - Overview: <http://www.ipsphereforum.org/newsevents/07nollereprint.pdf>

Thank You !



"I made it!!"