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Number Portability in the emerging hybrid IN/IP Telephony Network - the Impact on Service Architecture

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Outline

- Assumptions
- Requirements and Motivation
  - Locating GWs from the IP Telephony network
  - Locating a SG from the ISDN network angle.
  - Number portability across the technology boundary.
  - GSM and 800 numbers.
- The solution
- Impact on Future Service Architecture
- Summary

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Assumtions

- We are headed towards fully peered SCN and IP-telephony networks due to
  - the increase in IP telephony connections and applications e.g. 3rd generation All-IP network and
  - SIGTRANs work
  - many connections between an SCN and an IPT network
- Efficient routing and numbering infrastructure across the emerging hybrid network is a necessity
  - Delay and jitter highly depend on call path
  - We want to minimize the times we need to do media conversion on the technology boundary

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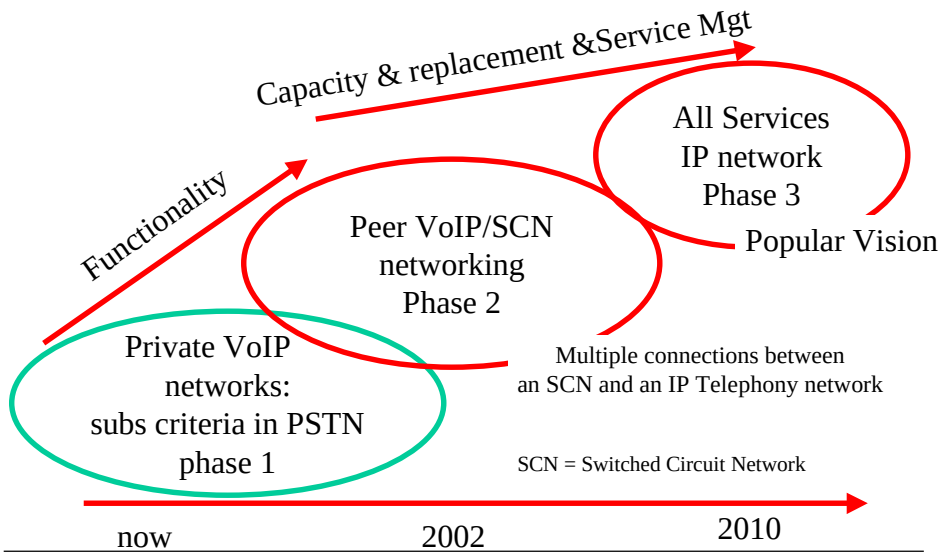
Roadmap to the Future



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Interoperability Issues

- Signaling and Call control
- Quality of Service

Phase 1
--->

- Telephony Routing and addressing
  - Input Information gathering
  - Alternative routing over IP

Phase 2
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- Service Management in the hybrid network

Phase 3

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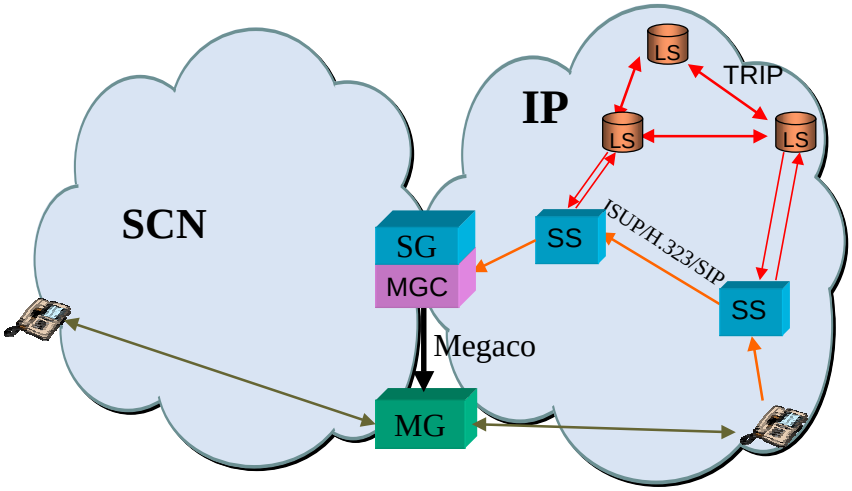
Architecture overview



TRIP = Telephony Routing over IP, SG - Signalling Gateway, MGC - Media Gateway Controller
MG - Media Gateway, SS = Signaling Server, LS = Location Server, SCN = Switched Circuit Network

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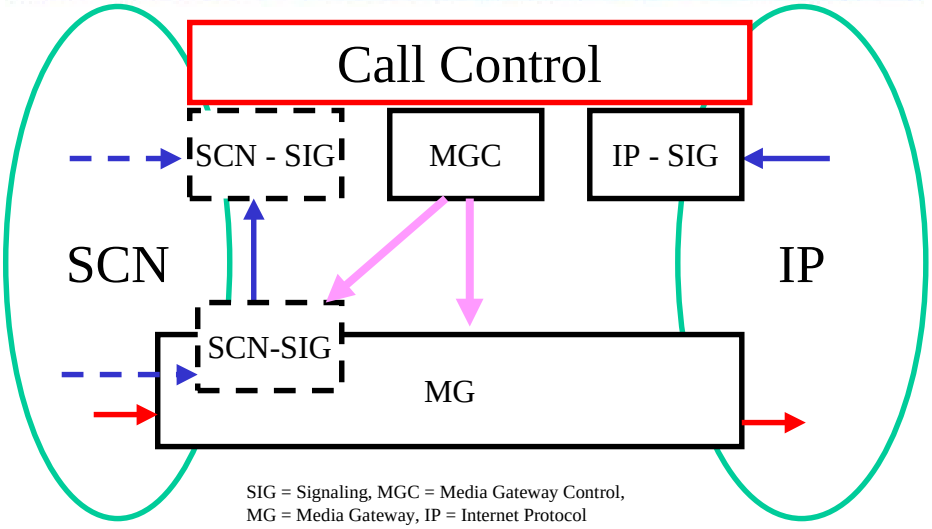
Gateway decomposed



SIG = Signaling, MGC = Media Gateway Control,
MG = Media Gateway, IP = Internet Protocol

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GW Location from IP side

- LS provides info about Next hop Signaling server e.g. a Signaling Server or an MGC in the same domain
- TRIP keeps information in LSs updated across IP Telephony systems
- MGCs are registered e.g in LS (this information may be local to an Admin Domain)
- SS can use LS to locate MGC and MG

LS = Location Server

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GW Location from ISDN side

- Good news: SGs are large - easy to locate
- Bad news: I do not hear any body working on the problem of Gateway location from the ISDN point of view
  - From the SCN it is equally important to select the most suitable Gateway for SCN to IP calls

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Numbering Issues

- What if an IP Telephony Number is ported to another ITSP operator?
  - ISDN side may need to choose another SG for calls to that number
- What if an ISDN number is ported to another ISDN operator?
  - IP side may need to choose another set of SG, MGC, MG
  - LSs need to know about the change
- What if a number is ported SCN to IP or vice versa

ITSP = Internet Telephony Service Provider

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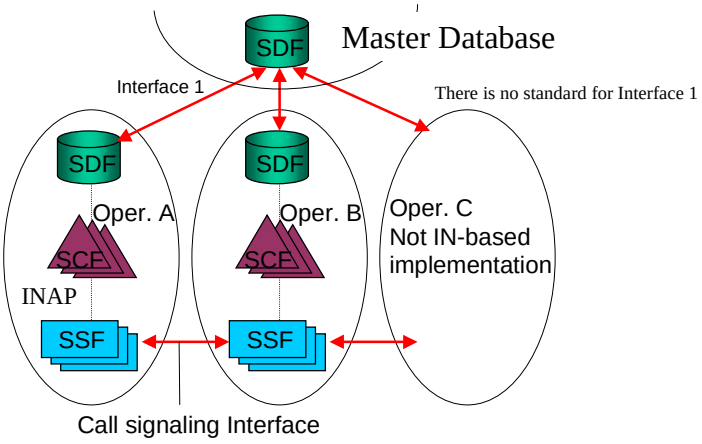
Current situation at the ISDN side

Number Portability is mandated by regulators in Europe and the US

Typical solution is based on IN



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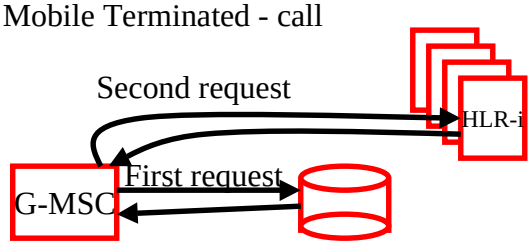
In mobile network NP is also required

This is mandated e.g by FCC in the US

Mobile Terminated - call



SRR gives
MSISDN -to- HLR
mapping

- SRR -database size: tens of millions of entries.
- These NE's are available now from Nokia, Nortel, etc…
- Limited to one technology, one operator ...

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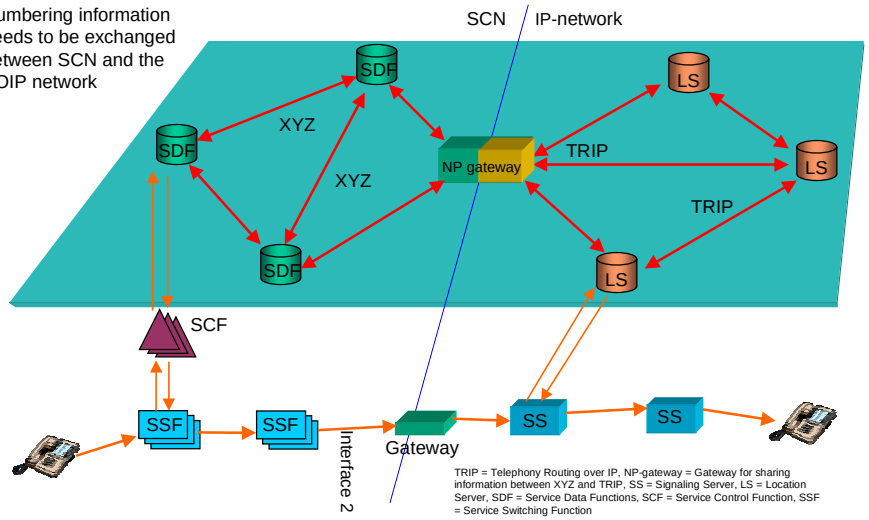
ISDN needs a pair to TRIP

Numbering information needs to be exchanged between SCN and the VOIP network



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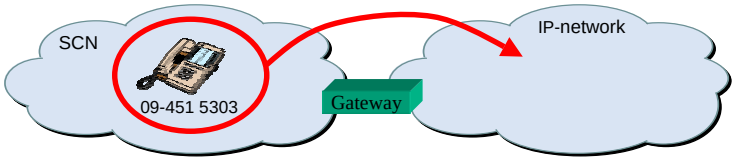
Requirements for Numbering&Routing

Number portability for IP subscribers

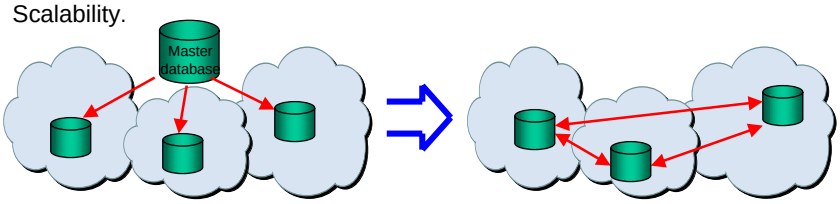
- ✓ Number portability within IP-networks.
- ✓ Number portability between the SCN- and IP-networks.
- ✓ Integration with the TRIP (Telephony Routing over IP) protocol for location of gateways and signalling servers. Integration with TRIP and DNS (enum) for location of IP terminals.
- ✓ Optimisation of routing between SCN- and IP-networks for portable numbers.
  - Location of nearest or most suitable gateway
  - Support for several geographical areas



Architecture for Numbering&Routing

Distributed architecture

- ✓ A distributed database instead of a single master database.
- ✓ No single point of failure.
- ✓ Master DB to SDF Interface replaced by a distributed database based on SCSP (Server Cache Synchronisation Protocol).
- ✓ Database updates made directly by the operators. Support for subscriber-initiated updates possible.
- ✓ Scalability.



Requirements for 800- and GSM numbers

- IP Telephony view
  - an 800-number and a Cellular Mobile Number may be located anywhere in the ISDN/PSTN cloud or the Cellular cloud respectively
  - additional round of indirection for choosing the GW is needed to ensure adequate quality voice
  - LS needs to cascade the request to an SDF or to an HLR or return the address of an SDF or HLR so SS can make a subsequent query
  - Alternatively a Redirect Server can be used to make the 800- and mobile number queries

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Requirements for 800- and GSM numbers

- SCN view
  - an 800-number (and a Cellular Mobile Number - only a matter of time!) may be located anywhere in the IP cloud
  - additional round of indirection for choosing the GW is needed to ensure adequate quality voice
  - SDF needs to cascade the request to an LS
  - It is not efficient to flood Mobile numbers among LSs when a mobile number is in an IP cloud - a solution scalable to frequent location changes is needed

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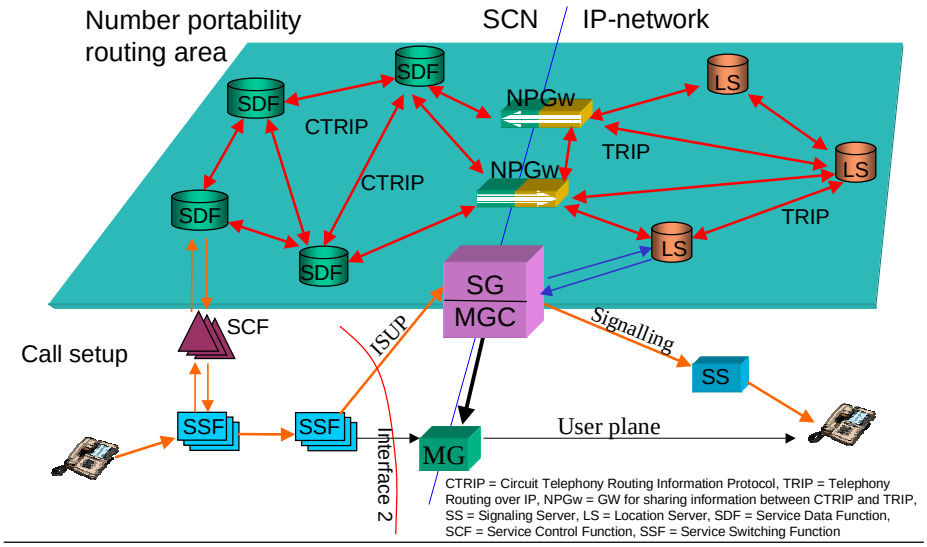
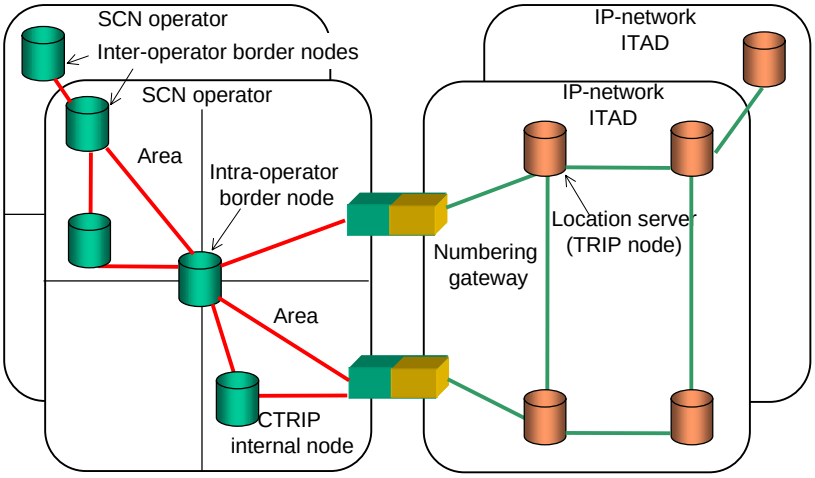
The solution is CTRIP + Numbering gateway



CTRIP = Circuit Telephony Routing Information Protocol, TRIP = Telephony Routing over IP, NPGw = GW for sharing information between CTRIP and TRIP, SS = Signaling Server, LS = Location Server, SDF = Service Data Function, SCF = Service Control Function, SSF = Service Switching Function

Functional Plane Architecture



TRIP attributes

Name	Description
Withdrawn routes	List of telephone numbers that are no longer available.
Reachable routes	List of reachable telephone numbers.
Next hop server	The next signaling server on the path towards the destination.
Advertisement path	The path that the route advertisement has traveled.
Routed path	The path that the signaling messages will travel.
Atomic aggregate	Indicates that the signaling may traverse ITADs not listed in the routed path attribute.
Local preference	The intra-domain preference of the location server.
Multi exit disc	The inter-domain preference of the route if several links are used.
Communities	For grouping destinations in groups with similar properties.
ITAD topology	For advertising the ITAD topology to other servers in the same ITAD.
Converted route	Indicates that the Application Protocol has been converted.

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ENUM (tElephone NUmbering Mapping)

- RFC 2916
- Maps E.164 numbers into Uniform Resource Identifiers (URI)
- The URIs represent different ways to contact a host
  - SIP, H.323, TEL, email, ...
- Uses the Domain Name System (DNS)
  - E.164 number rewritten as a domain name:

```
    +358-9-4515303
->  3.0.3.5.1.5.4.9.8.5.3.e164.arpa
```

- Provides simple number portability

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Route selection in TRIP and CTRIP

- Selection performed by policy functions
  - Defined for each network (TAD)
  - Calculates a preference value based on the attributes
  - Highest preference route for each prefix selected

- Selection is based on attributes
  - The operators on the path
  - Number of intermediate network
  - The type of the intermediate networks
    - Used to minimize numbers of media conversions
  - The signaling protocols on the path
  - Properties and capabilities of the gateways
  - Cost
  - New attributes can be added

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CTRIP attributes

Name	Description
Withdrawn routes	List of telephone numbers that are no longer available.
Reachable routes	List of reachable telephone numbers.
Next hop address	The network and routing number pattern of the next hop.
Advertisement path	The path that the route advertisement has traveled. Loop avoidance.
Routed path	Path for signaling.
Atomic aggregate	Indicates that the path can contain networks not included in Routed Path.
Local preference	The intra-domain preference of the route.
Multi exit disc	The inter-domain preference of the route if several links are used.
Communities	For grouping destinations in groups with similar properties.
Domain topology	For advertising the ITAD topology to other servers in the same ITAD.
Converted route	Indicates that the Application Protocol has been converted.
IP destination	Indicates the origin of the route to a prefix on the IP network.
Number portability state	Indicates the state of a moving number.

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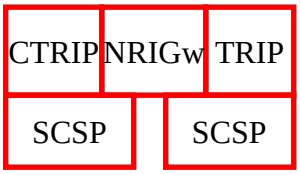
Conclusions on NP



- Gateway model needs to be complemented by Numbering&Routing Information gateways

- TRIP, CTRIP and possibly ENUM are used to distribute Routing information among Location Servers and SDFs
- Location servers need to be able to cascade requests to cater for 800-numbers, any service specific routing methods and for mobility

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Where this is leading?

- We can move around routing information records from operator to operator with routing attributes for calls to any number
  - cmp. IN triggers and attributes
  - attribute might say: ask more routing info from server X (over IP).
  - Any number translation algorithm can be bound to any telephone number.
  - Distribution of numbers and attributes is controlled by policy.

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What is the business impact?

- More open network
- Service provisioning becomes less dependent on access network
- Private translation servers can be attached to the network - those servers can be based on any technology.
- Corporations and subscribers can have more control over incoming calls
- Efficient and flexible service management in the emerging hybrid network

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What will happen to IN?

- IN as we know it today is limited to call related services and circuit switched networks.
- In IP broadband networks (e.g 3G networks), services combine voice, data and video freely.
- In IP networks, switching layer and service layer are independent - therefore IN BCSM does not make sense.
- From technology point of view, it does not make sense to stretch IN to IP Telephony. A Native IP based approach is required.
- Due to open network architecture, many Service Architectures can and will live in parallel.

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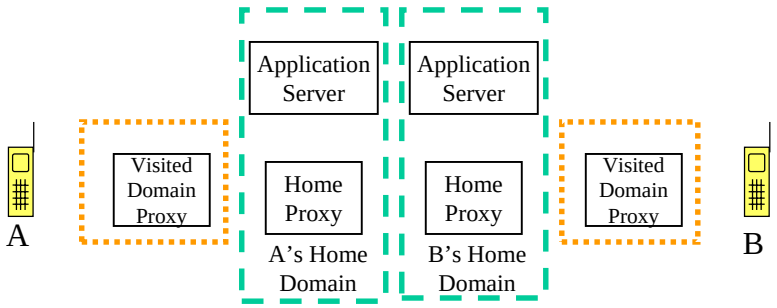
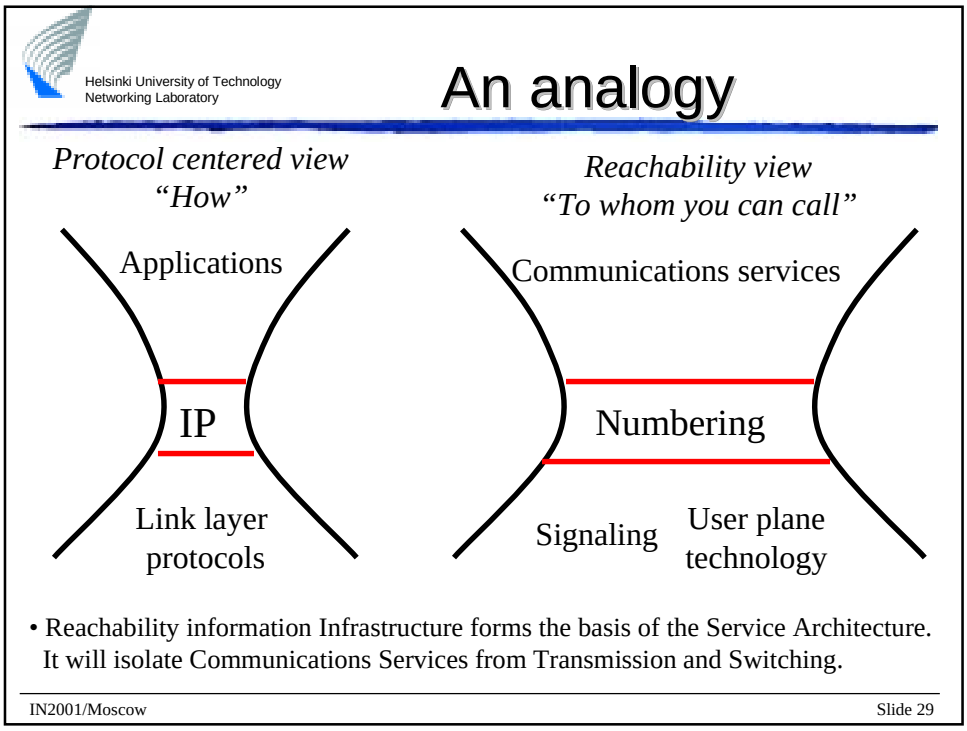
Example 3G Service Architecture



- Services are always provided by the home domain Proxy and Application Server
- Media plane routing and Service routing are independent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An analogy
Protocol centered view
"How"
Applications
IP
Link layer
protocols
Reachability view
"To whom you can call"
Communications services
Numbering
Signaling
User plane
technology
• Reachability information Infrastructure forms the basis of the Service Architecture.
It will isolate Communications Services from Transmission and Switching.
IN2001/Moscow
Slide 29