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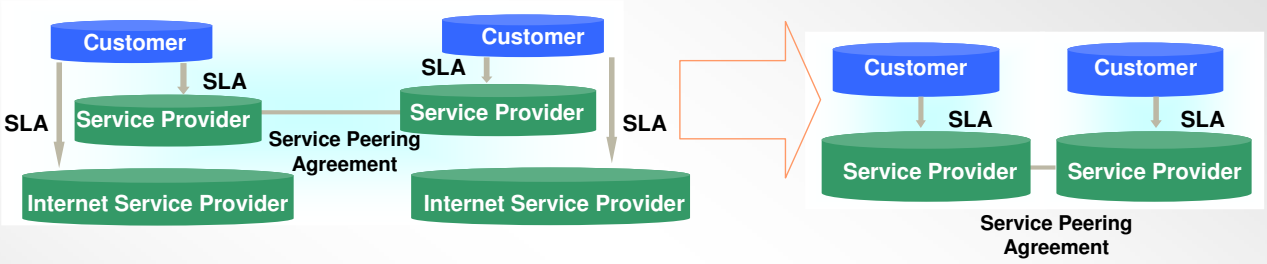
Potentials of P2P-SIP Architecture in Telecommunications

Eurescom Study P1755

Project Scope

- IMS is the SIP-oriented call control and service platform favoured by large telecom vendors and operators.
- At the same time, low-cost P2P infrastructures are emerging
- However, these are not reliable and secure and bear interoperability weaknesses
- The study analysed the potential and impact of the most promising P2P technologies for IMS based voice and multimedia services
- The main goals of the study were
  - ➔ Identification of business opportunities
  - ➔ Evaluation of the P2P-SIP potentials in IMS architectures

P2P Skype Business Model



Value proposition: Voice communication

Customer group: Internet users who subscribe the Skype service via a SLA

Partnership agreements: In order to reach remote (telephone) destinations such as mobile destinations or landlines, Skype service domain must interconnect with external telephony domains owing to a negotiation of a *Service Peering Agreement* (SPA). This contract can be unidirectional or bi-directional

Revenue: revenue is based on fees accounted by end users to use SkypeOut and SkypeIn services

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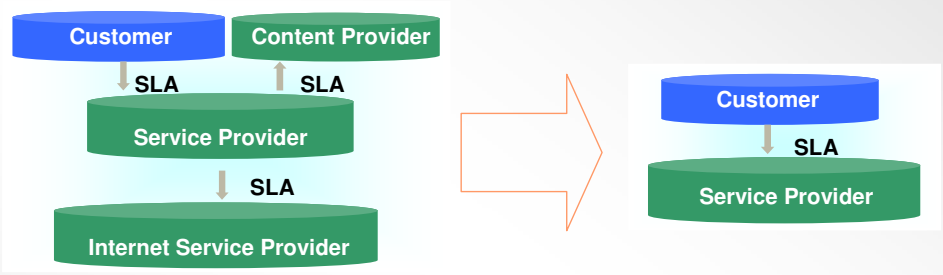
P2P TV - Joost



Value proposition: TV over the Internet

Customer group: Broadband Internet users who subscribe the TV service via a SLA. Joost could also be seen as a customer of the Internet Service Provider

Partnership agreements: Appropriate contracts have been negotiated by Joost with "*Content Provider*", where DRM aspects are taken into account, with the customer and with the Internet Service Provider.

Revenue: revenue is based on advertisement

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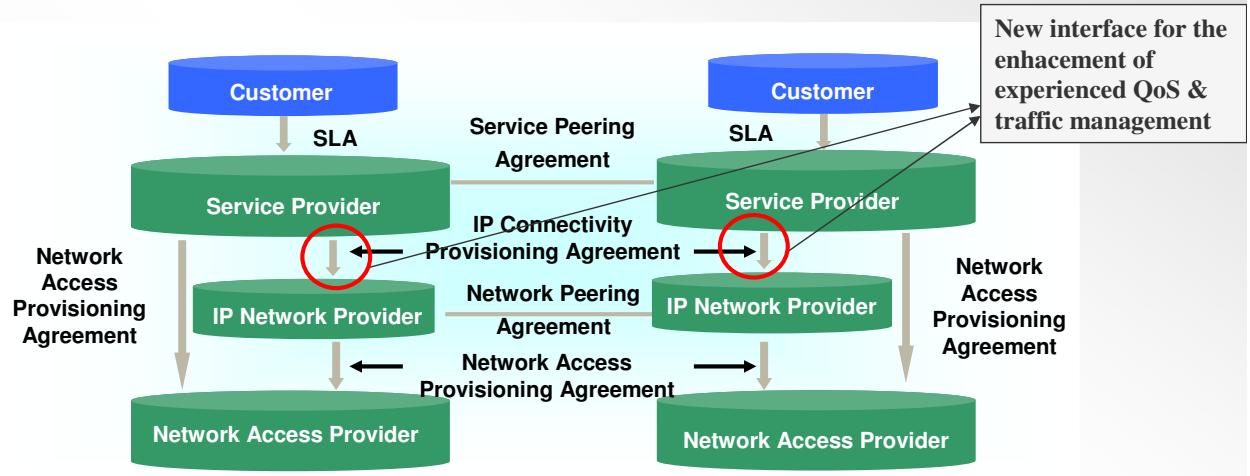
Business Actors and Relationship for the Future



"*IP Network Providers*" owns and administer one or many IP domain(s) composed of interconnected IP equipment and IP resources

"*Service Providers*" administer a set of equipment and service-specific resources (such as billing means, authentications procedures, customers' profiles databases, etc.) which interact for the delivery of *IP Services* (such as IP TV, Telephony, music content and online gaming).

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Regulatory constraints

- EU Regulatory framework for electronic communications
  http://europa.eu/scadplus/leg/en/lvb/l24216a.htm
  - ➔ Framework Directive: 2002/21/EC,
  - ➔ Authorisation Directive: 2002/20/EC,
  - ➔ Access Directive: 2002/19/EC,
  - ➔ Universal Service Directive: 2002/22/EC,
  - ➔ Privacy and Electronic Communications Directive: 2002/58/EC.
- The European Regulators Group (ERG)
  - ➔ Set up by the Commission in 2002
  - ➔ Composed of the heads of the relevant national authorities
  - ➔ ERG common position on VoIP:
    http://erg.ec.europa.eu/doc/publications/erg_07_56rev2_cp_voip_final.pdf

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ERG common position on VoIP

Service Categories	Outgoing access to PSTN	Incoming access from PSTN	E,164 number provided
Service 1	No	No	No
Service 2	Yes	No	No
Service 3	No	Yes	Yes
Service 4	Yes	Yes	Yes

- Task Force Recommendations and Conclusions:
  - ➔ **Emergency services relevant for service categories 2 and 4**
  - ➔ **Numbering relevant for service categories 3 and 4**
  - ➔ **Number portability relevant for service categories 3 and 4**
  - ➔ **Legal intercept requirements for category 2, 3 and 4 may be imposed by national law**

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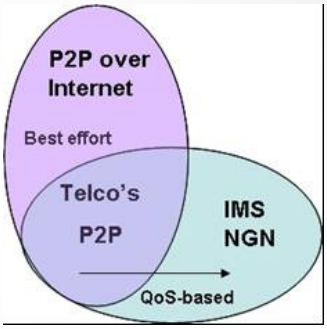
Standardization

- Status is somewhat confused
- Main bodies with activities towards P2P:
  - ➔ IETF – P2PSIP:
    protocols and mechanisms between peers, security and NAT
  - ➔ DSL Forum: Architecture & Transport Working Group:
    TR-144: requirements for moving to a generic converged architecture
  - ➔ TISPAN defines a Border Gateway Function BGF
  - ➔ IMS is solidly based on the IETF SIP protocols, but nothing is clear and settled in the P2PSIP working group



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State of the Art – Standardisation

- IETF/IRTF Activity
  - ➔ P2PSIP Peer-to-Peer Session Initiation Protocol
  - ➔ primary tasks of the P2PSIP working group
    - **Concepts and Terminology for Peer to Peer SIP**
    - **A standard defining a P2PSIP Peer Protocol.**
    - **A standard defining a P2PSIP client protocol (optional)**
    - **A usage document**
  - ➔ P2PSIP standardisation is in a rather premature state
    - **No RFC at all !**
  - ➔ Multicast
    - **Native multicast: (RFC 5110, 2008. Jan)**
      - ↗ **Not scalable**
    - **Application-level multicast (ALM)**
      - ↗ **Demonstrated, but not standardised**

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State of the Art – Standardisation

- IP TV TISPAN
  - ➔ IMS subsystem based IP TV architecture:
    - **Specifies the architecture and functions**
    - **Still under development.**
  - ➔ Dedicated IP TV subsystem
    - **Architectural framework for the IP TV within the NGN**
    - **For IP TV functions in NGN**
    - **Interaction with other NGN subsystems will be considered**
    - **Already deployed widely by incumbent network providers**

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State of the Art - Proprietary solutions

- Beside academic solutions, various P2P overlay service offerings have been deployed
- Service offerings described with respect to Offered Service, Design/architecture overview, Main functional characteristics, Interconnection Issues, Customer base
  - ➔ Joost, Octoshape, Skype, PPlive, TVAnts
- It can be concluded that
  - ➔ The architectures are comparable
  - ➔ The service offerings are mature
  - ➔ The customer base is impressive with respect to number of subscribers as well as important customers (e.g. BBC)
  - ➔ However, QoS features are missing for comprehensive service offering

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The true real value of content

- The real value of content is rather controversial
  - ➔ discussions are going on worldwide
  - ➔ No consensus
- Long-lasting tradition of overemphasising the content
  - ➔ Not unambiguously supported by the facts – study by A. Odlyzko based on '94-'97 and historical data:
    Content is Not King, http://firstmonday.org/issues/issue6_2/odlyzko/index.html
  - ➔ Conclusion: people are really willing to pay for the person-to-person communications
  - ➔ Recent data from France, Japan, and Hungary are not in contradiction with these conclusions

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The resurrection of HTTP traffic

- How to measure and to assess the popularity of Peer-to-Peer applications?
- Taxonomy of conveyed traffic
- P2P traffic **was** a predominated traffic
  - ➔ this is not anymore valid
  - ➔HTTP is currently increasing

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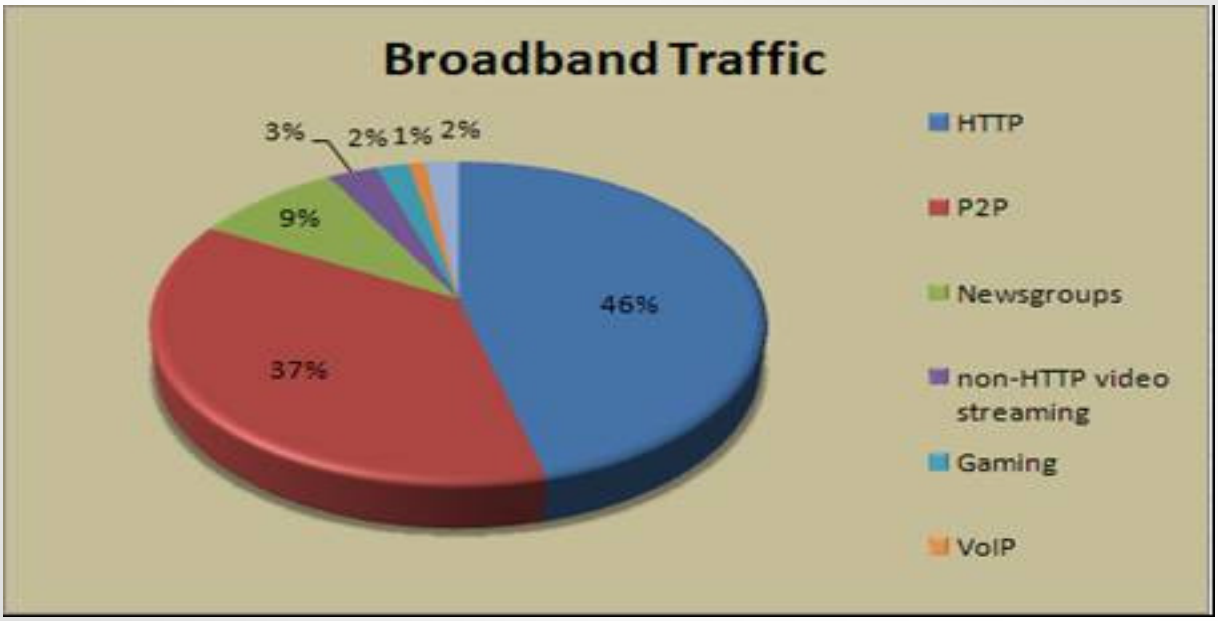
The resurrection of HTTP traffic



Traffic distribution (Source Ellacoya Networks)

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New Market segments

- P2P in general and P2P-SIP in particular may potentiate new market segments for all the involved actors: consumers, service and Network Providers and equipment manufactures.
  - → Opportunities for **equipment manufacturers** → caching content from recognized P2P protocols or promoting the integration of consumer electronics, like entertainment systems and appliances, using P2P networking;
  - → **Device manufacturers** have already proven in commercial products that a P2P PBX for example can be implemented such that all the PBX functions reside in the end devices – the desktop phones, PCs and mobile devices;
  - → The **Small and Medium Business (SMB) VoIP market** is one of the targets of Siemens, Avaya and others, and they are offering a new Peer-to-Peer SIP VoIP phone system;
  - → In **governments** for emergencies and disasters where the telecom infrastructure could be out of service, providing an ad-hoc wireless network can be easily set-up in time of need and then layered on top of that a P2P communications system;
  - → Peer-to-peer systems are not just applicable to consumer telephony applications, but also can be used to **scale carrier applications** based on content on demand. Using the carrier P2P TV is a means of monetizing traffic being also able to distribute for user-generated content over their network.

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Potentials of P2P and distributed techniques

- Allow dynamic and autonomous behaviours instead of static/frozen one.
- Implement scalable service offerings through “intelligent”/”suitable” load distribution
- Avoid DoS (Denial of Service) and SPAM attacks since the service logic is distributed among several nodes. The impact of a DoS attack may not be critical as for a centralised service platform
- Enable fast re-route, failure detection and failure repair
- Enhancing service reliability is also a valid challenge
- Allow fast convergence, stable and with no oscillation phenomena

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Potentials of P2P and distributed techniques

- Reduce system complexity and advocate for lightweight solutions
- Reduce CAPEX and OPEX
- Enhance QoS
- Ease management functions
- Allow load balancing and load sharing
- Allow deterministic behaviours

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Enhancing Robustness of IMS-based architectures – Taxonomy

- Access segment: This segment encloses functions which are required for connecting customers' equipment to the service. This segment may include for instance BGF or P-CSCF
- Core segment: This segment is the place where the service logic and required functions such as routing, billing, etc. are hosted. Within IMS architecture, this segment is responsible for interconnecting to internal or external AS (Application Servers). Examples of core IMS functional elements : I-CSCF, S-CSCF, HSS etc
- Border segment or Interconnection segment: This segment groups required functions to interconnect with external realms. These external realms may be VoIP ones, PSTN, PLMN or any other voice service domain

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Enhancing Robustness

- The main objective of this scenario is to describe a set of viable solutions aiming to enhance the robustness and the availability of current IMS-based architectures owing to the activation of P2P and distributed techniques
- A Service Provider's standpoint is adopted for the deployment of P2P and distributed techniques
- The adopted rationale argues in favor of introducing P2P and distributed means into current operational service platforms in order to build survival and deterministic networks
  - ➔ P2P-like and distributed means are not used as alternative solutions but as an enhancement to the already deployed ones
  - ➔ For backward compatibility and for migration issues, it is recommended to enforce the proposed solutions as backup ones in the earlier stages of deployment
  - ➔ Once field proven, the proposed mechanisms could be enforced as primary procedures to deliver more sophisticated services
- Several Failure scenarios are considered

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Enhancing robustness – Failure scenarios

- Failure of access nodes: This section describes a lightweight approach based on appropriate engineering practices so as to prevent against failures and to provide the service even in case of failure of access nodes. The proposed mechanism is transparent to end-users. This mode does not require any involvement of humans
- Failure of core nodes: We propose an autonomic mode where access nodes collaborate in order to offer the service even in case of failure of core service elements. This mode is transparent for end-users. Failure detection and restoration are dynamic and do not require any decision by human administrators
- Over-load phenomenon: Dynamic solution to prevent against flash crowds phenomena and against the crash of service elements. Automatic setting of call acceptance ratio is enforced owing to a distributed decision-making process implemented by access nodes

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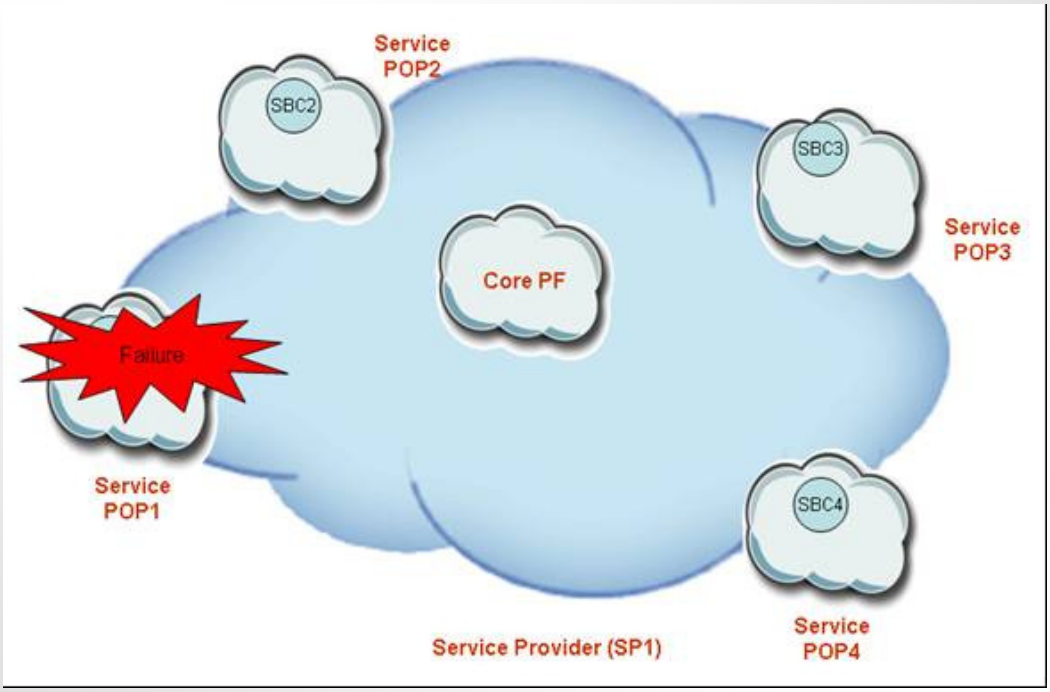
Failure of access nodes



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Failure of access nodes – proposed solution

- Several IP addresses are assigned to the inner interface of SBCs (i.e. customer-SBC interface)
- These addresses are also assigned to other SBCs
- Several modes of IP address assignment may be envisaged
  - ➔ Unilateral mode: this mode assumes that a given SBCj is the backup SBC of SBCi
  - ➔ Bilateral mode: unlike the previous mode, SBCs are organized as (SBCi, SBCj) pairs where SBCi is the SBC backup of SBCj and vice versa
  - ➔ Distributed mode: SBCs are organized as groups.
    - **Each POP is composed by N customers attached to a given SBC**
    - **The Service Provider distributes its N customers to M groups**
    - **For each group a distinct IP address is provisioned.**
    - **This address is the one to use to reach the primary SBC.**
    - **For each SBC, several primary addresses are assigned to the inner interface**

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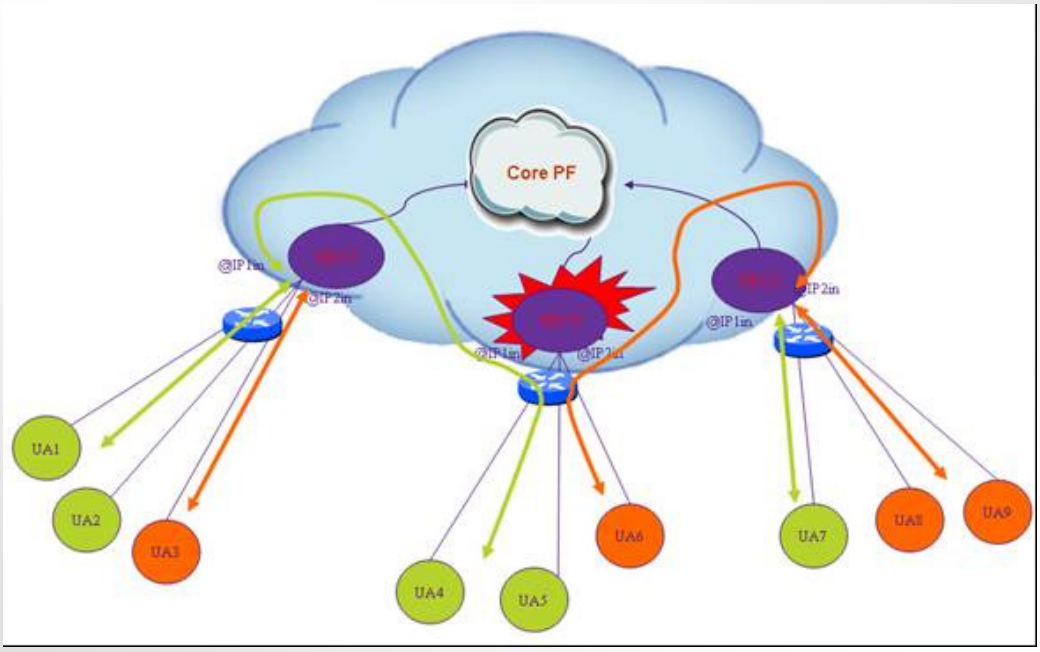
Failure of access nodes – proposed solution



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Failure of core segment

- When access to core service nodes is broken
- Problem related to:
  - ➔Availability of the service nodes
  - ➔Routing;
  - ➔Etc.

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Failure of core segment – Proposed solution

- Proposed solution: Unlike current IMS-based deployments, this solution aims to involve actively SBC nodes in the failure detection and reactivation processes
  - ➔ Assess the availability of core service through the invocation of dedicated messages
  - ➔ Detect an un-reachability problem between a given SBC and core service platform
  - ➔ Adopt a collaborative mode in which SBC will intervene in the routing resolution process.
  - ➔ Two scenarios may be envisaged:
    - **(1) Partial Failure: This means that at least one SBC can reach core service nodes. In this scenario, a new procedure is introduced and implemented by SBCs. This procedure consists to select an SBC_PROXY which will relay messages to core service platform.**
    - **(2) Full Failure: All SBCs fail to reach core service nodes. Once this occurs, all SBCs activate their autonomous mode and are acting as a network of co-equal peers, intervening during the routing process. Messages are not routed to core service nodes anymore, but are processed by SBCs themselves.**

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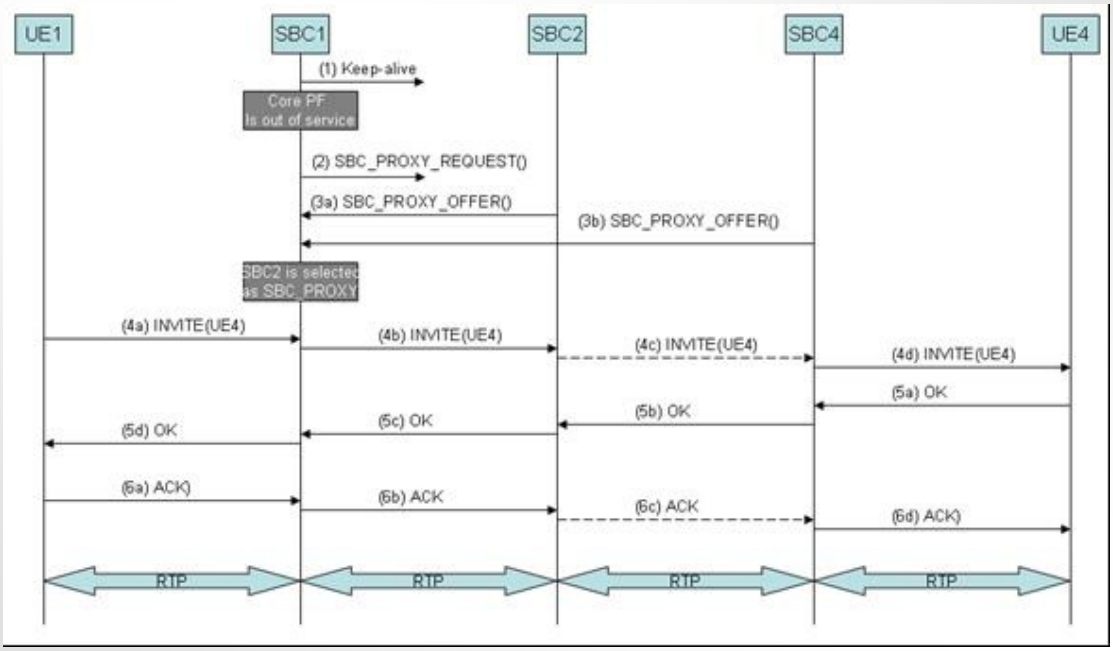
Failure of core segment – Proposed solution



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IP TV/Video streaming I

- Video distribution system must meet the following requirements
  - ➔ The system must provide a small delay (less than 5 s)
  - ➔ Small delay (less than 5 s) between channel switch
- Today's IP TV platform are mainly
  - ➔ dedicated IP TV subsystems
  - ➔ IP layer multicast systems
- These systems are characterized by:
  - ➔ Client/Server approach
  - ➔ Direct pipes between Client and Service Nodes
  - ➔ Multiple Service Node instances
  - ➔ Parallel distribution to each client
  - ➔ Huge bandwidth consumption

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IP TV/Video streaming II

- P2P overlay network have emerged and entered the market
- These architectures face some drawbacks
  - ➔Proprietary protocols and clients lead
  - ➔Limited upstream bandwidth in most DSL access environments
  - ➔Lack of interoperability
  - ➔High channel change delay

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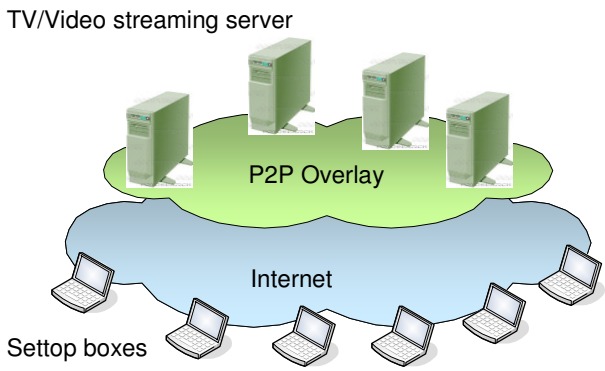
IP TV/Video streaming III

Proposal: P2P for a server cluster

- TV/video streaming servers would organize itself using P2P technology
- An end device contacts one of the IP addresses listed in the DNS
- The contacted server would use a P2P protocol to determine a server that already distributes the desired video stream
- A re-distributing server could use the P2P protocol to get a list of alternative servers
- The contacted server can redirect the end device to a less busy server
- If an upstream server fails, it can quickly recover
- The P2P protocol allows quick integration of new servers



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Presence

- Presence and Instant Messaging are strongly correlated
- Information presence can give:
  - ability of communication (online/offline),
  - mode of possible communication forms (web-cam,receive video),
  - wish of communication (don't disturb),
  - place of the user (at home, at work),
  - personal notes
- Popular applications use proprietary protocols, no interoperability
- SIP can support instant messaging and presence information handling
- Presence server becomes a performance bottleneck
- Proposed solution: IMS-based NGN network, with centralised servers
- For IMS: P2P network to support presence handling capabilities

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More information

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