Introduction

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Change of the Internet - Original vs. today's Situation

- Original design assumptions of the Internet:
  - main service: data communication between research centers (no commercial target)
  - uniform user requirements
  - trust relations between users
  - users with high level of technical skills
  - consistent network architecture
- Situation of the Internet today:
  - global infrastructure for the information society
  - several new interest groups / commercial aspects
    - Internet Service Provider (Internet-access provider, transit provider)
    - Application Service Provider (e.g. Email-service, Webhosting)
    - Content Provider (Video on Demand, …)
  - loss of trust relationship
  - users with almost no technical skills
  - introduction of various extensions e.g. to solve problems on short notice
    - however, these extensions often do not fit very well to the original Internet architecture and lead to inconsistencies

Change of the Internet - Trends and Consequences

- Internet Trends:
  - Voice over IP:
    - main driver: cost reduction
    - shortfalls compared to traditional telephone networks: speech quality, robustness
    - advantages compared to traditional telephone networks: new value-added services possible
    - key question: how to guarantee QoS (especially if VoIP is deployed globally)
  - Video streaming/IPTV → Multimedia Communication
  - Peer-to-Peer Networking
  - Social Networking
  - Machine-to-Machine Communication / Smart Grid
  - Mobile Internet
- Consequences:
  - the Internet becomes a critical infrastucture - failures lead to high costs or high loss of revenue
  - QoS, resilience and security are essential

Change of the Internet - Problems

The current Internet Architecture does not cope with today's requirements:

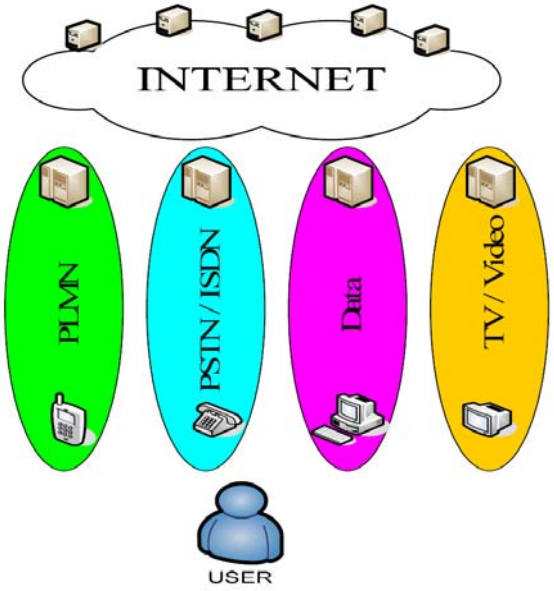
- large number of connected hosts
  - lack of IPv4 addresses → IPv6
  - increasing complexity, less manageability → increasing self-organisation
- mobile hosts
  - mechanisms for mobility support → e.g. Mobile IP
- high quality multimedia applications
  - mechanisms for quality of service (QoS) support → differentiated treatment of data packet (vs. net-neutrality)
- tele-cooperation / multicast-streaming
  - mechanisms for group communication / multicast support → e.g. IP Multicast
- e-Commerce applications
  - enhanced requirements regarding reliability, security ...
- easy introduction of new services/applications
  - increasing number of different services → flexible service platforms, peer-to-peer overlays

Next Generation Internet (NGI) - NGI Requirements

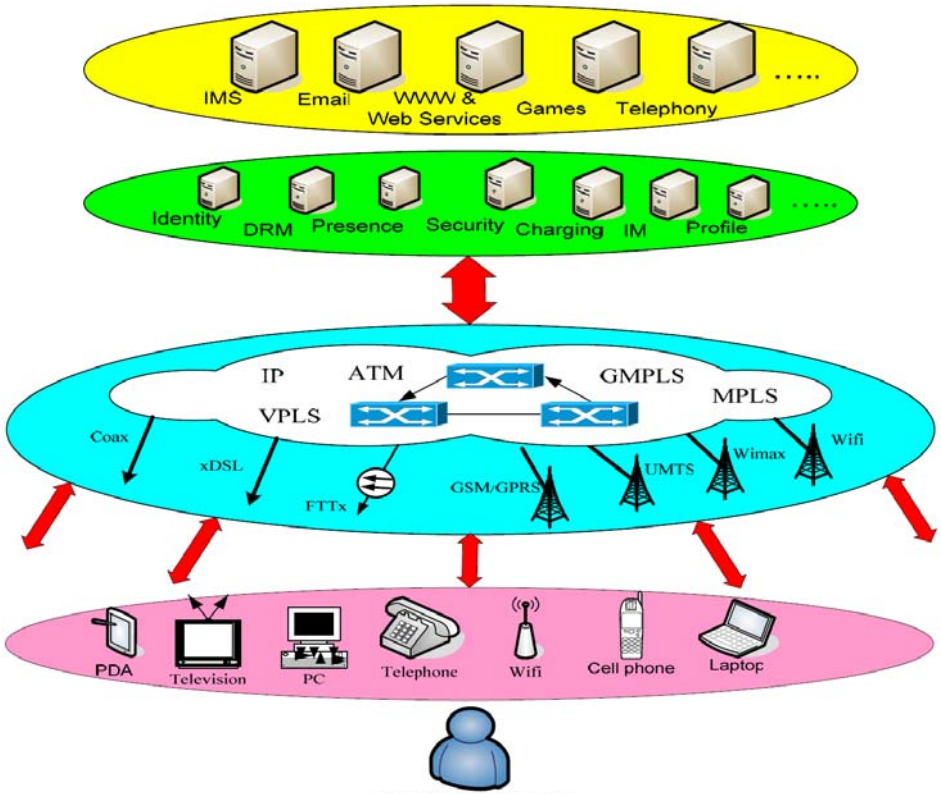
- Group Communication Support
  - today mostly realized either via centralized servers or fully meshed hosts
  - more efficient solution: IP multicast
    - drawback: rarely supported by ISPs
  - challenges
    - scalability (i.e. support of large, distributed and heterogeneous groups), security, charging
- Quality of Service Support
  - today mostly realized via overprovisioning ("throw bandwidth at the problem")
  - more efficient solution: bandwith reservation or priorization mechanisms
    - drawback: rarely supported by ISPs, no global (Internet-wide) solution
  - challenges
    - scalability, fairness, charging, QoS management
- Mobility Support
  - today mostly realized within layer 2 domains (LANs)
  - network-wide solution: mobile IP
    - drawback: rarely supported by ISPs
- Reliability
  - today mostly realized by redundant network architecture (meshing, multi-homing) and restoration/rerouting mechanisms
    - problem: increasing size of routing tables

Next Generation Internet (NGI) - NGI as Part of the NGN

current Architecture



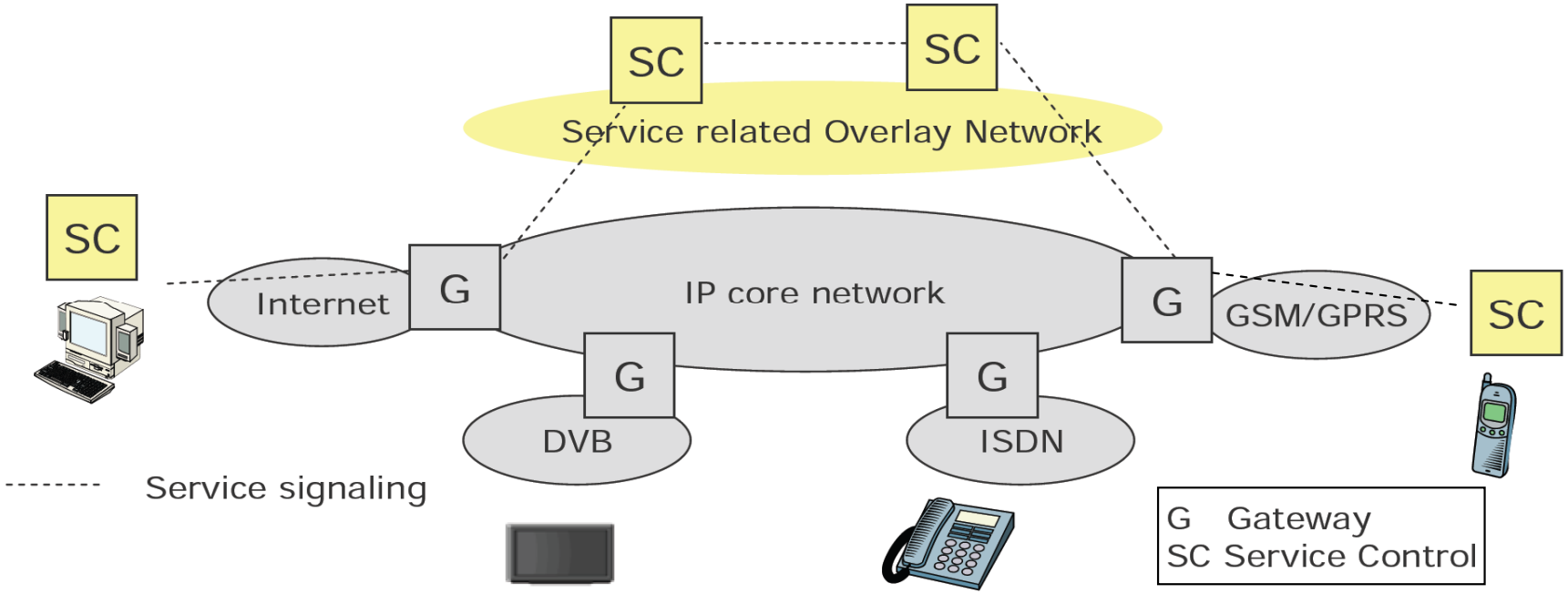
future NGN Architecture



today:
- **service-specific networks**
- **vertical layering**

future:
- **multiservice networks**
- **horizontal layering**

NGN - Generic NGN Architecture



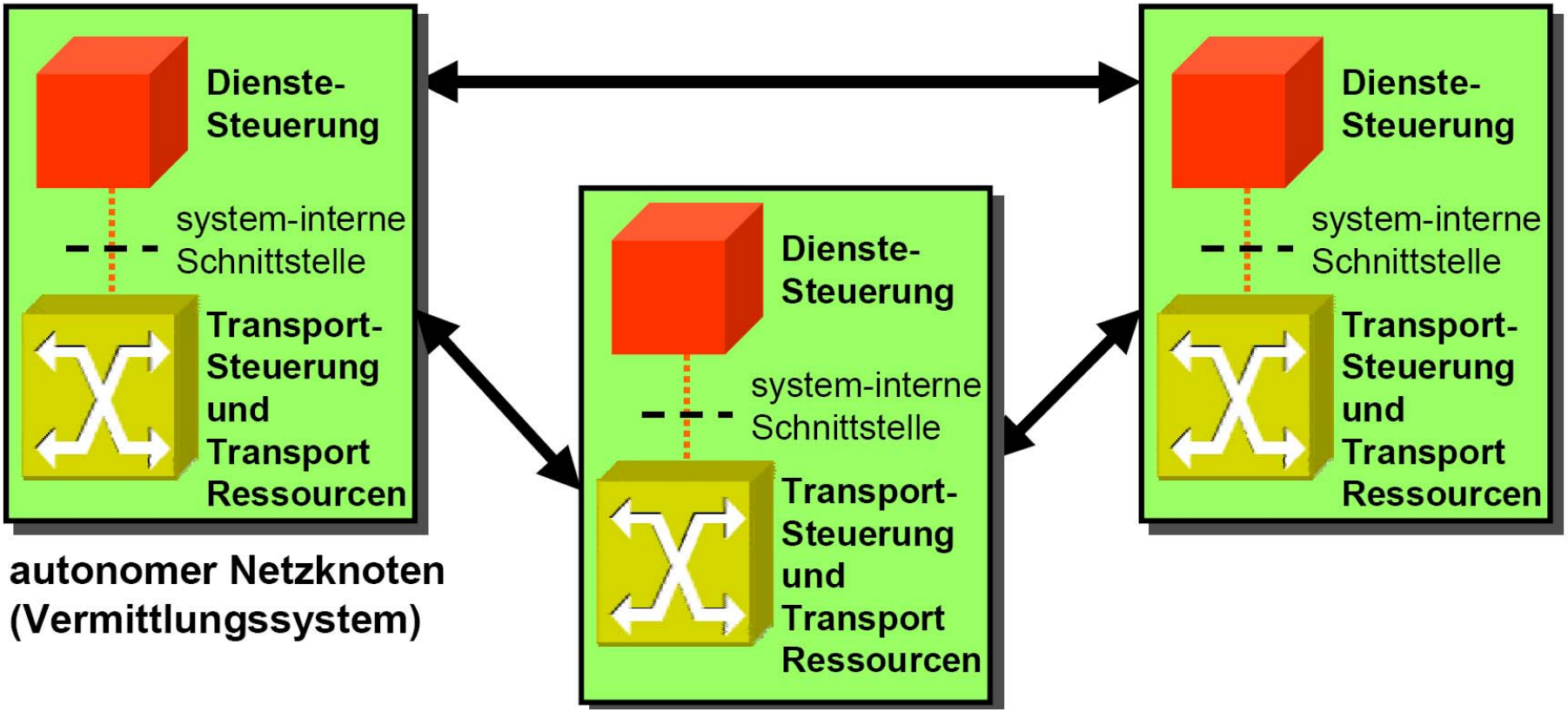
Characteristic of the NGN:

- IP-based core network as backbone for different (wired or wireless) access networks
- separated architecture: separation of (user data) transport and (connection and service) control
- legacy network elements are connected to the NGN via gateways

NGN - Evolution towards the NGN (Example: Telephony)

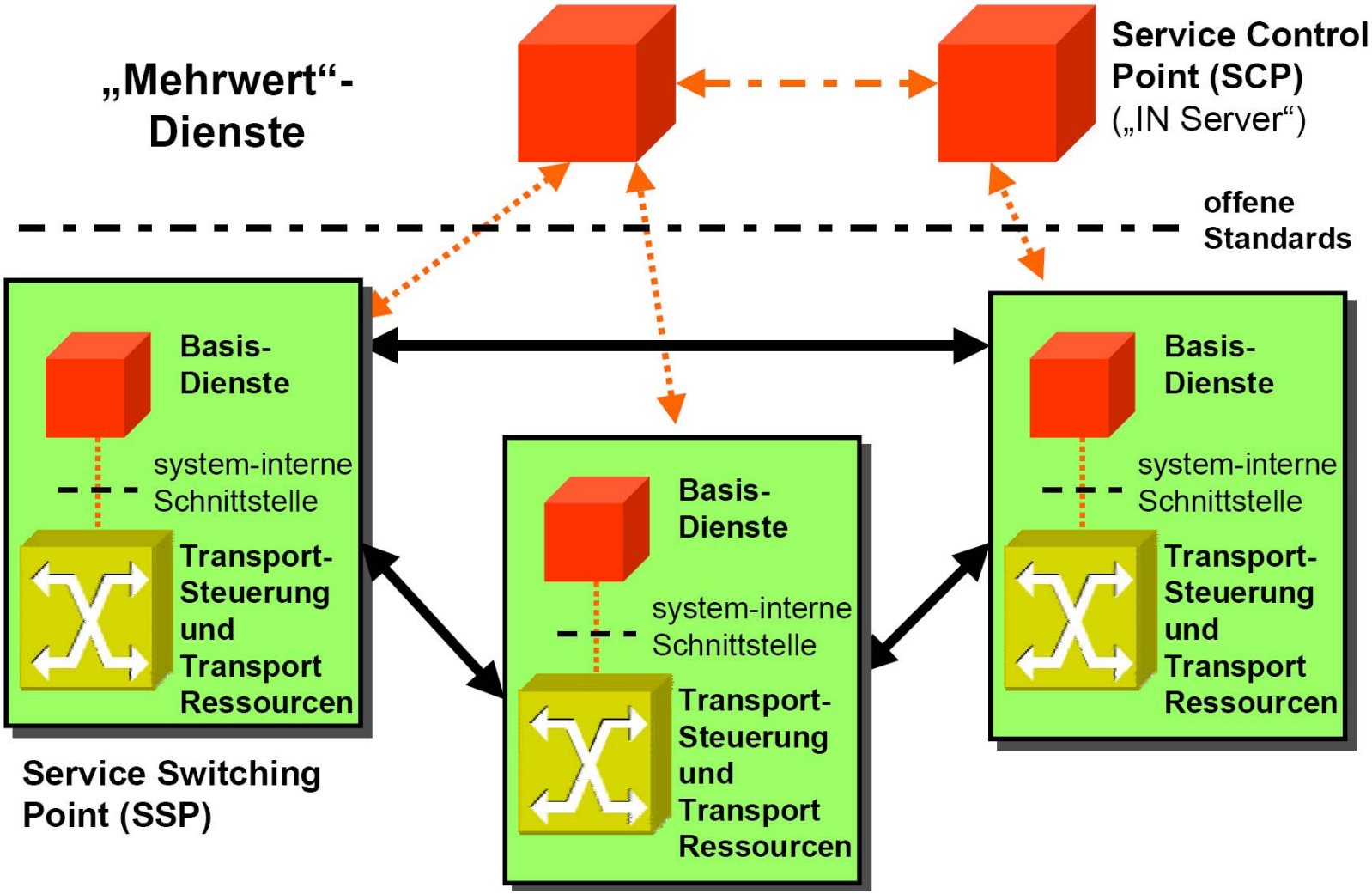
(1) Traditional Solution:

- call/service control integrated in switching system
- each node knows all the services and controls these services



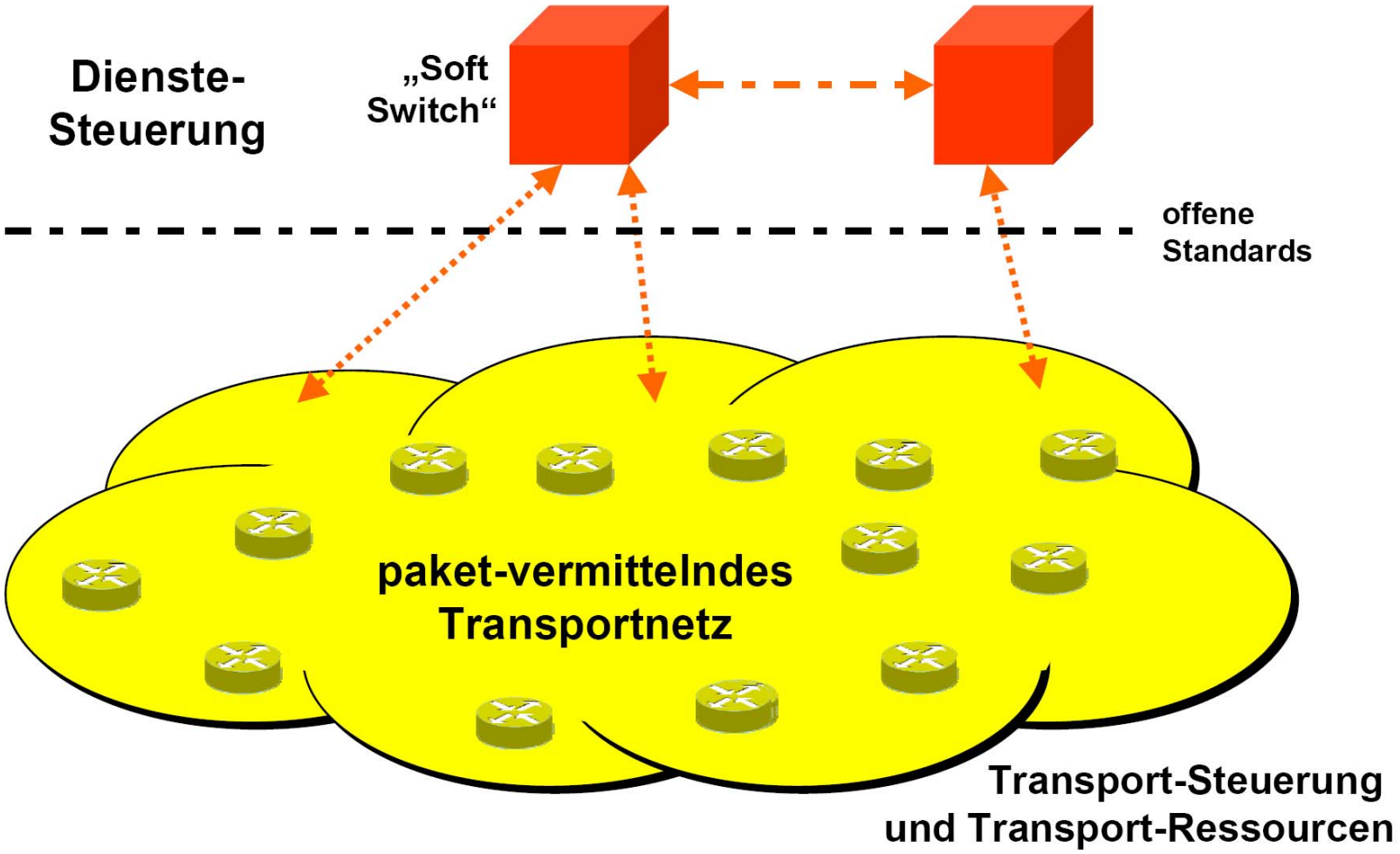
NGN - Evolution towards the NGN (Example: Telephony)

(2) IN Introduction:

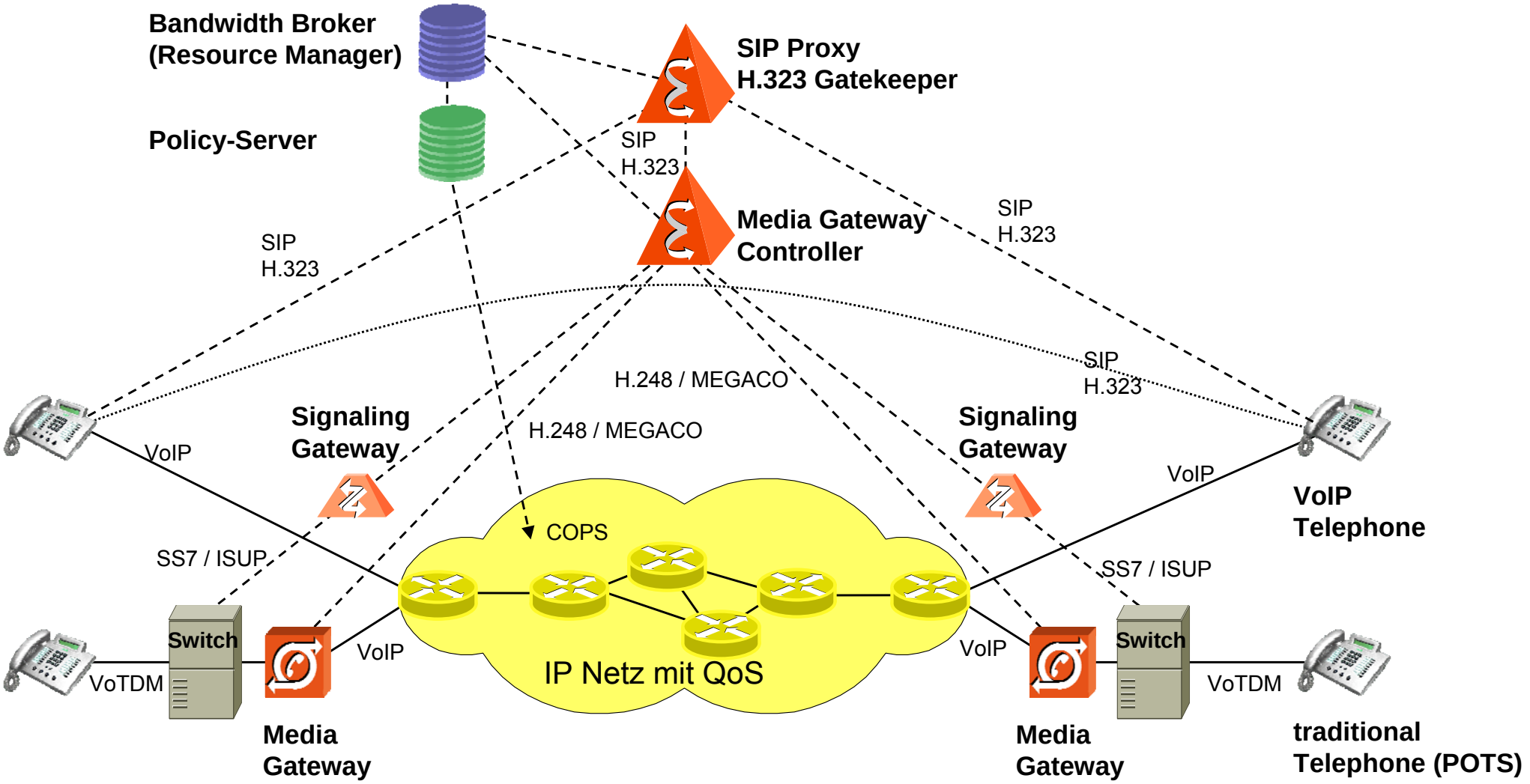


NGN - Evolution towards the NGN (Example: Telephony)

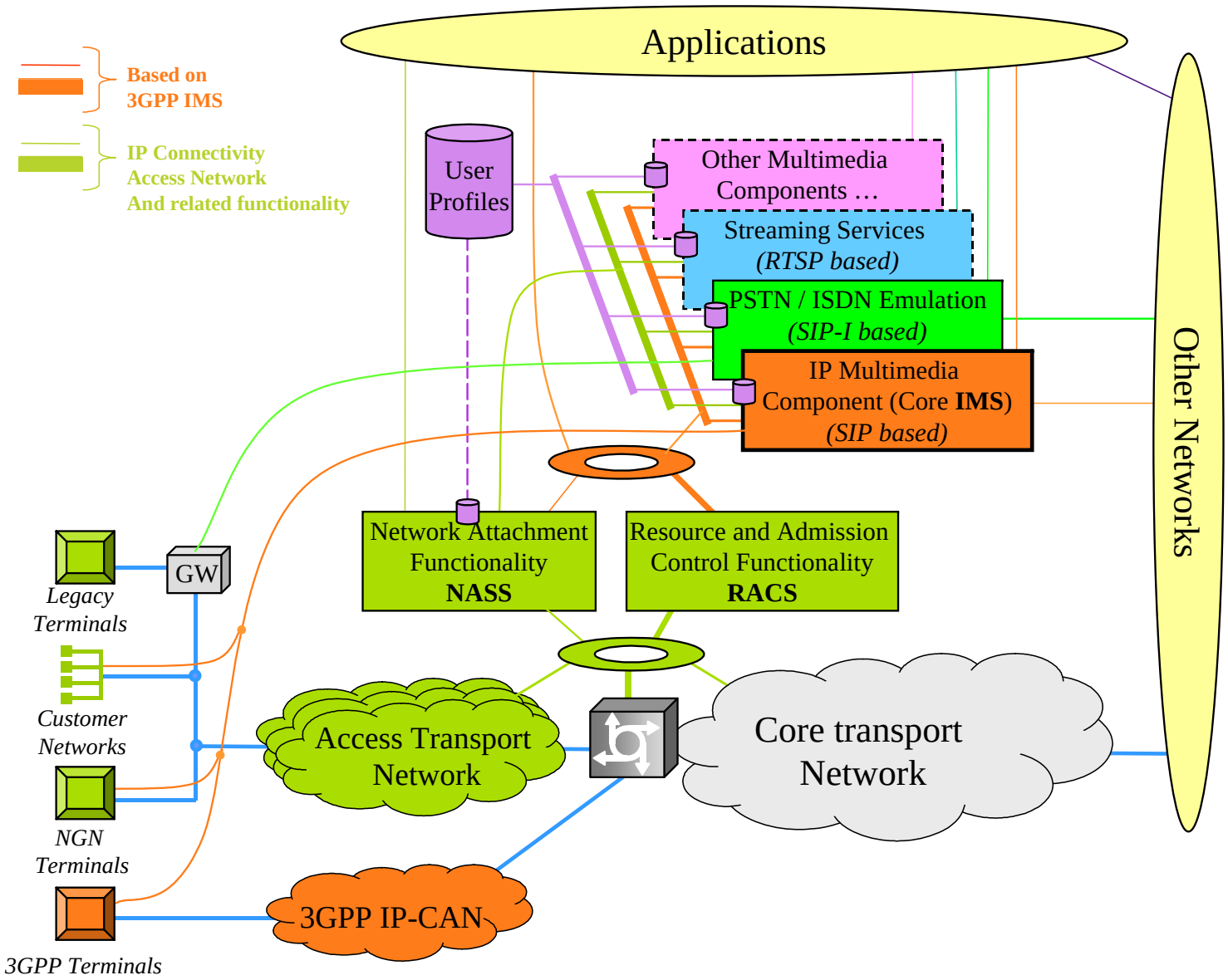
(3) NGN Solution:



NGN - Voice Service in the NGI (Example Scenario)



NGN - ETSI TISPAN* (Release 1) Architecture



* Telecommunications and Internet converged Services and Protocols for Advanced Networking