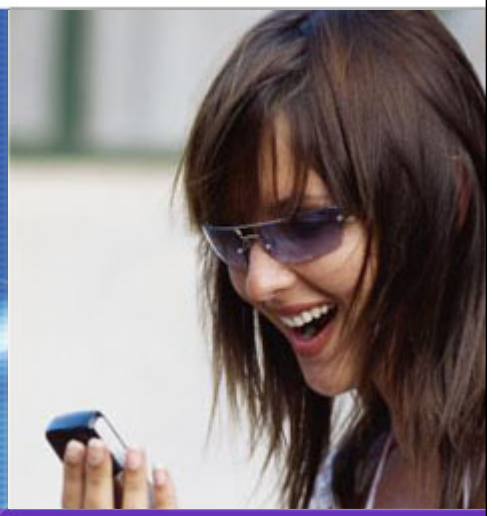
Next Generation Converged Network Architecture and Application



Amit Mukhopadhyay &

Carlos Urrutia-Valdés,

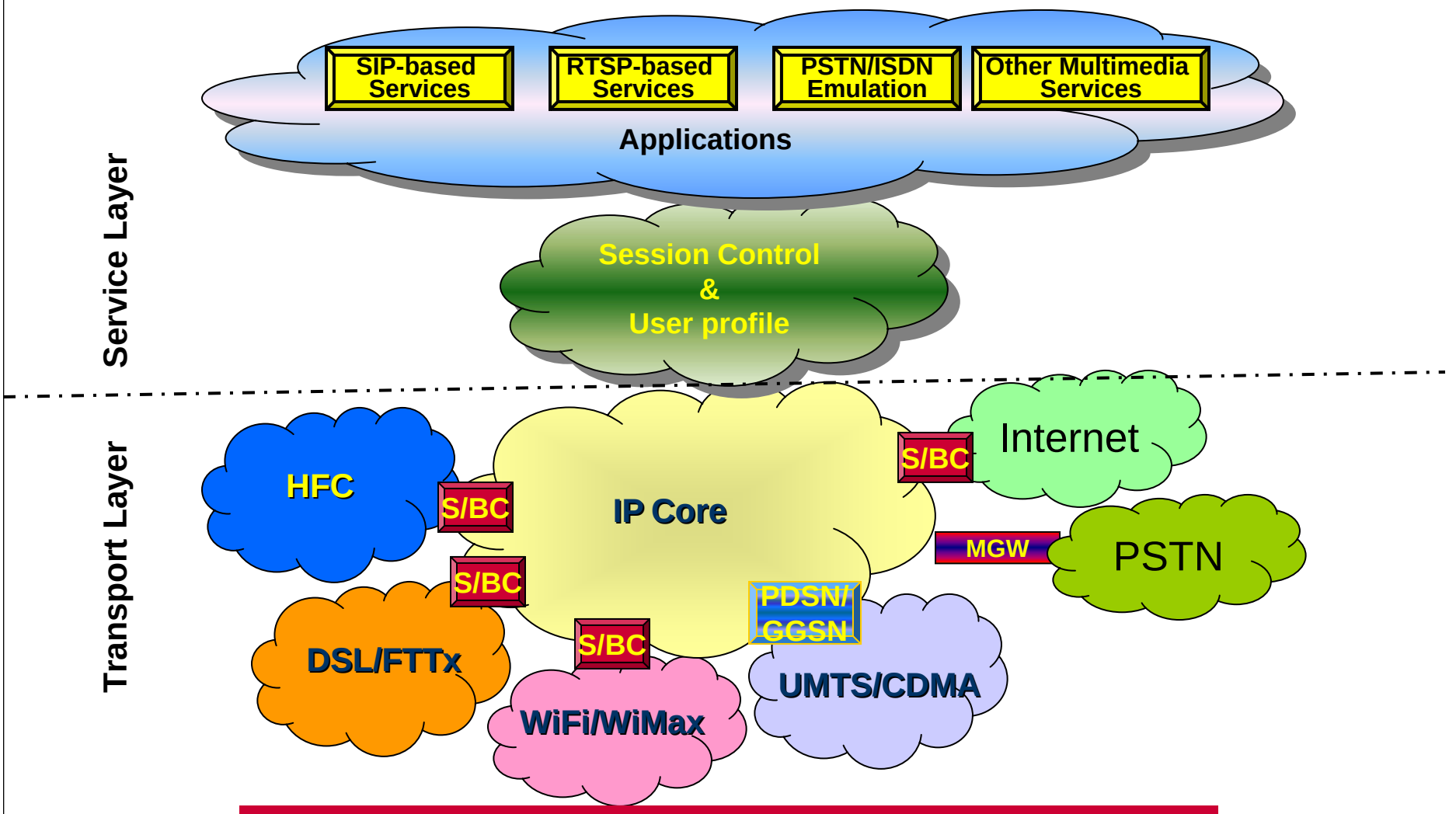
Bell Labs, Alcatel-Lucent

October 2007

Outline

- High Level Architecture of Next Generation Networks
  - What is NGN?
- Yesterday, Today and Tomorrow
  - Wireless-Wireline Convergence Example
- IMS Recap
  - Building Blocks and system components
- Introduction to Blended Services
  - Bundling vs. Blending
- How is blending achieved?
  - Introduction to the SCIM and SCIM+
  - Examples
- IMS, SDP, and SDEs
  - Soft Definitions
  - Challenges
- A View of Nirvana??
- Summary
- Acknowledgments

NGN Architecture



Multiple applications supported over a common infrastructure

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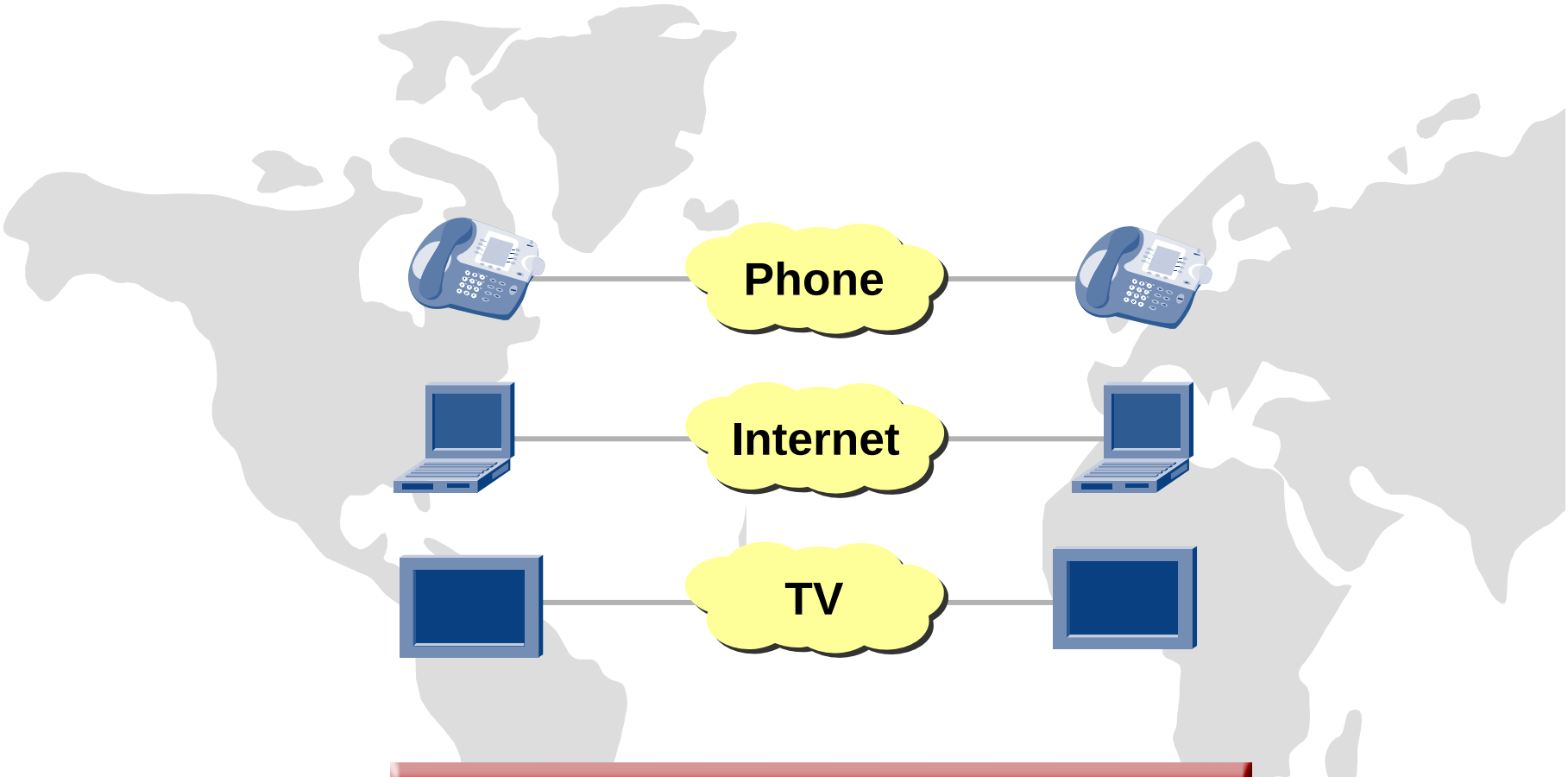
Convergence – Many Aspects

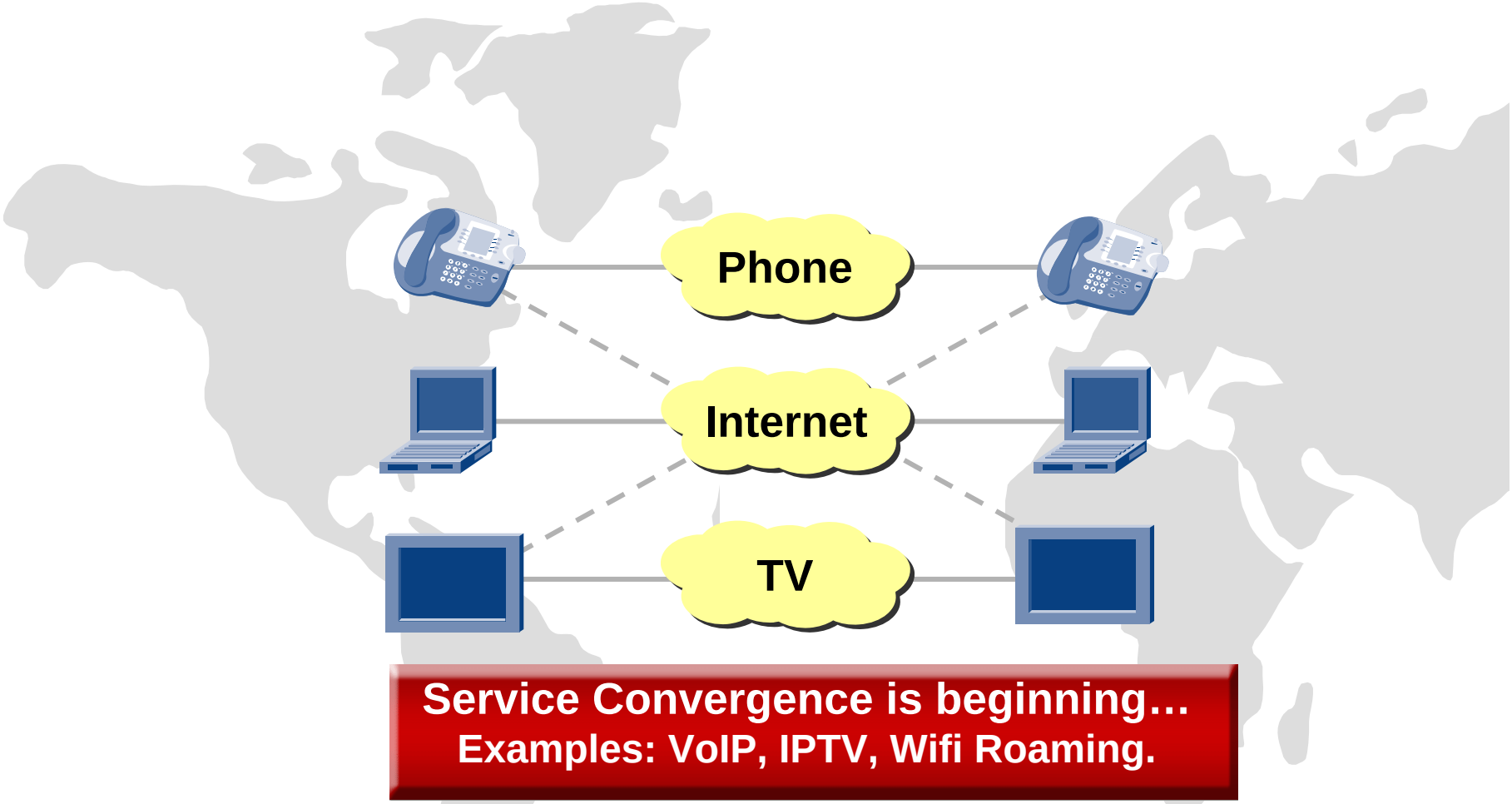
Drivers	Increase Revenue	Reduce Cost
Dimensions	End-User	Network
	Service Interaction	Shared network resources
	(e.g. Voice+ IMM) Service Bundling	(e.g. one core network) Network-agnostic platforms
	(e.g. Lifestyle Services) Seamless Roaming	
	(e.g. WiFi-Mobile, Mobile-Wireline) Common Experience	
Enablers	(same look & feel) Common session control	Common transport network (e.g. Core, MGW)
	(e.g. IMS) Common service platforms (e.g., App. Servers, MRFP)	Centralized Operations (e.g. common NOC, Std interfaces, Billing)
	Unified end-user terminals & APIs	Common database platforms (e.g. HSS, AAA)

Yesterday World of Communications



Yesterday's communications world: Separate networks and services.

Today's World of Communications



Service Convergence is beginning…
Examples: VoIP, IPTV, Wifi Roaming.

IMS, through the separation of session control from the application and transport layers, provides a framework for this convergence.

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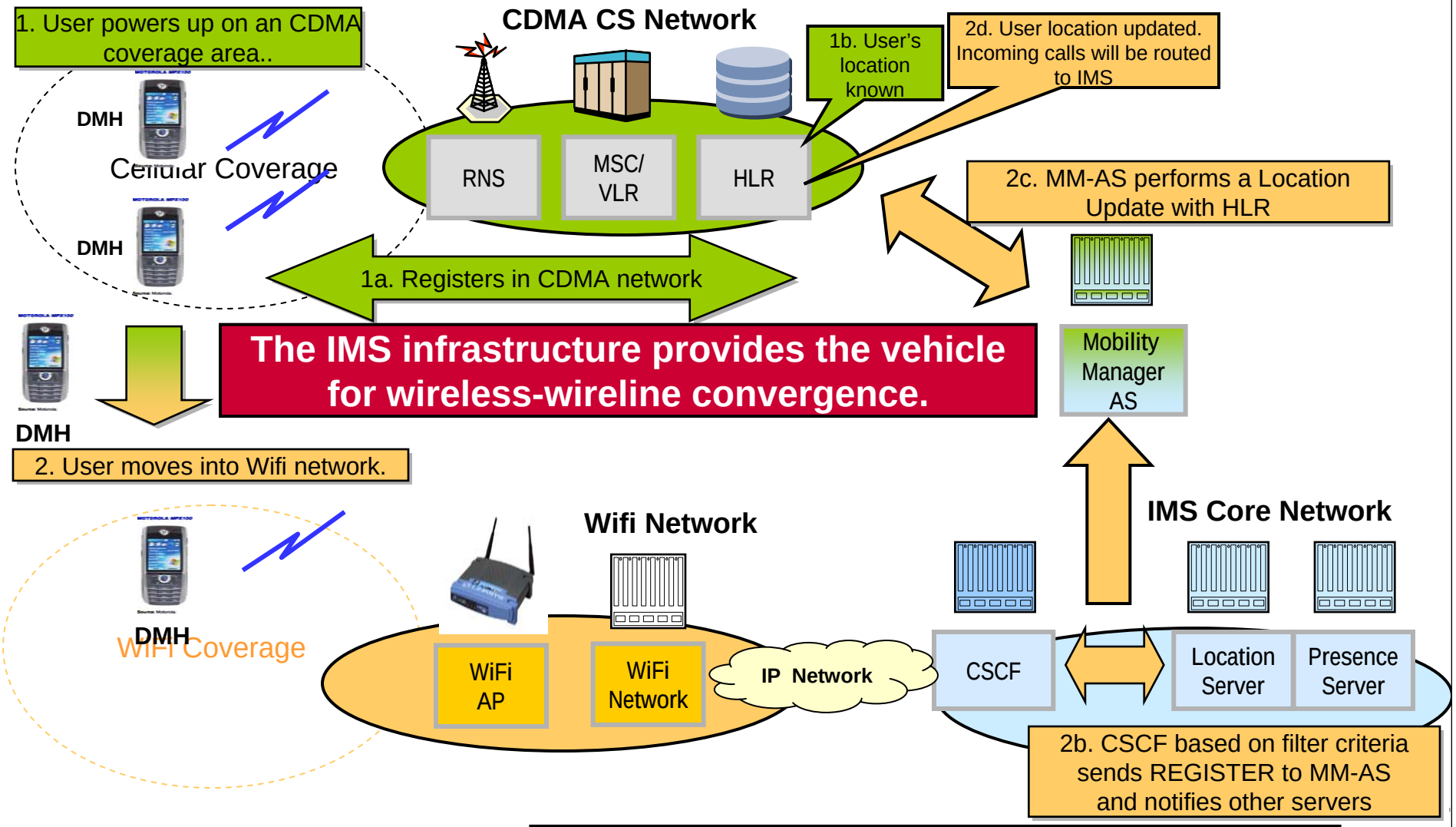
IMS & Wireless-Wireline Convergence

Wifi Roaming Example



User can originate and received calls on either network.

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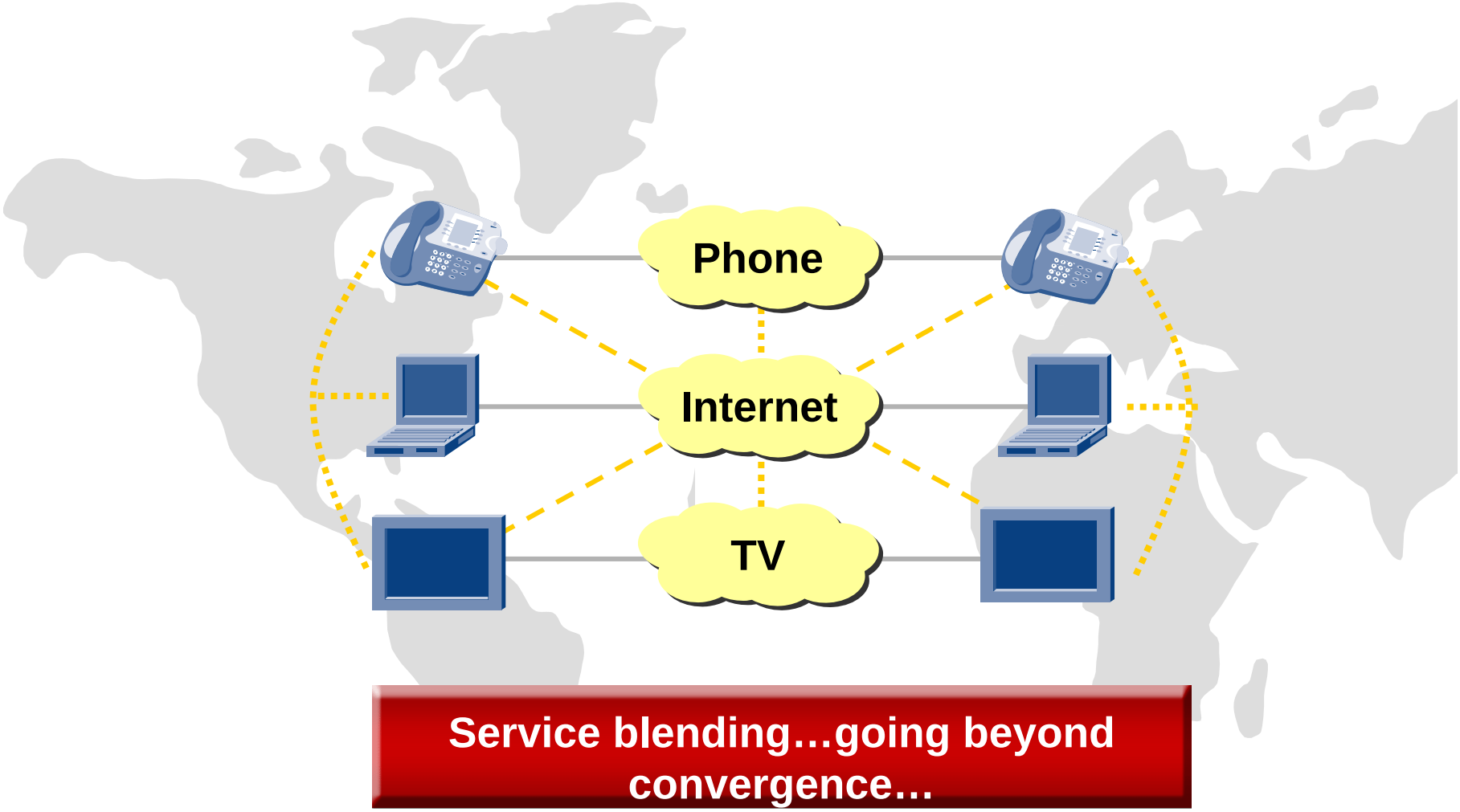
The Future World of Communications



What is IMS?

Original (late '90s/early '00s) definition per 3GPP TS 23.228:

The IP Multimedia CN subsystem comprises all CN elements for provision of multimedia services. This includes the collection of signaling and bearer related network elements…

Ability to mix multiple media during a session is a key characteristics of IMS:

- Simultaneous voice, data and video applications
- Different media with different QoS requirements
- Common resources shared across multiple applications for service providers
- Common "touch-and-feel" for subscribers

More Current View:

Architecture designed for IP Multimedia Services

Originally developed by 3GPP (for UMTS) and later adopted by 3GPP2 (for cdma2000); now being investigated by ITU,..

Support of other access technologies (e.g., DSL, Cable, Wi-Fi) a vision

Capable of Interworking with PSTN

Defined with Open Standard Interfaces

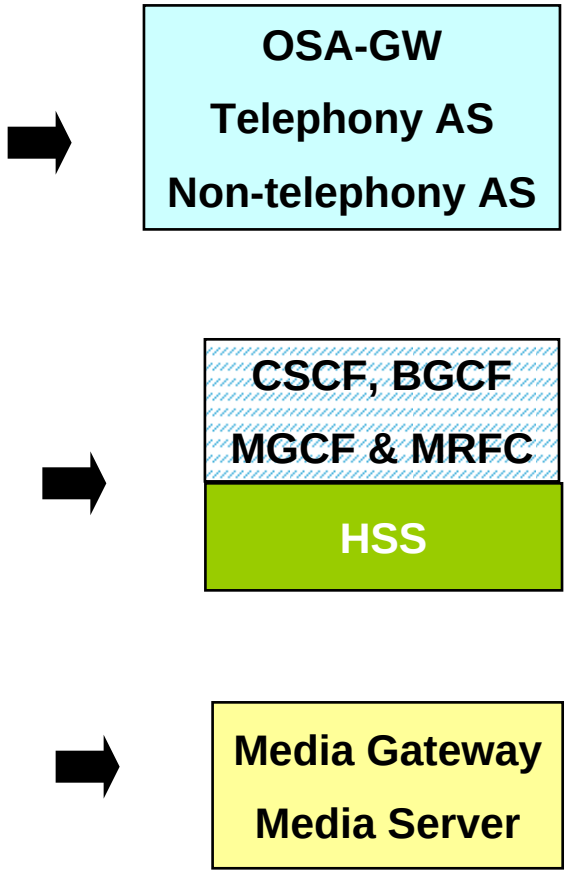
Based on IETF Protocols (SIP, RTP, ...)

A Solution for Service Transparency

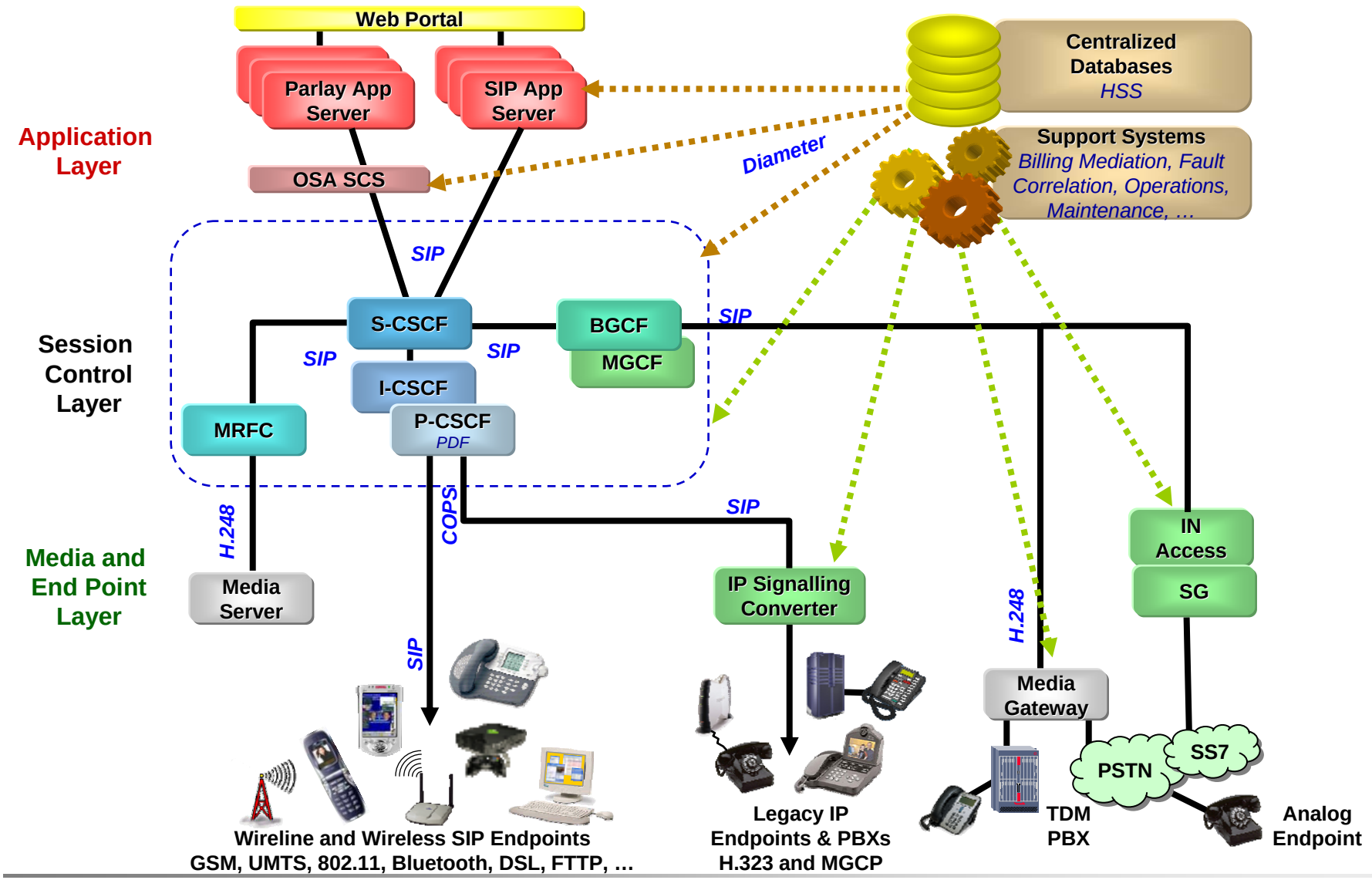
Interaction with Legacy IN Based Services

IMS Building Blocks

- **Applications Layer**
  - End-user telephony service logic
  - AIN call trigger points
  - Non-telephony based services
  - APIs for enterprise & legacy applications
- **Session Control Layer**
  - End Point Registration
  - Session setup
  - QoS establishment
- **Transport & Endpoint Layer**
  - Bearer Services, Media Conversion (PCM > IP)
  - Special functions: announcements, touch tones collection, voice recognition, speech synthesi



3GPP/3GPP2 IMS Inspired Architecture



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IMS Entity Definitions

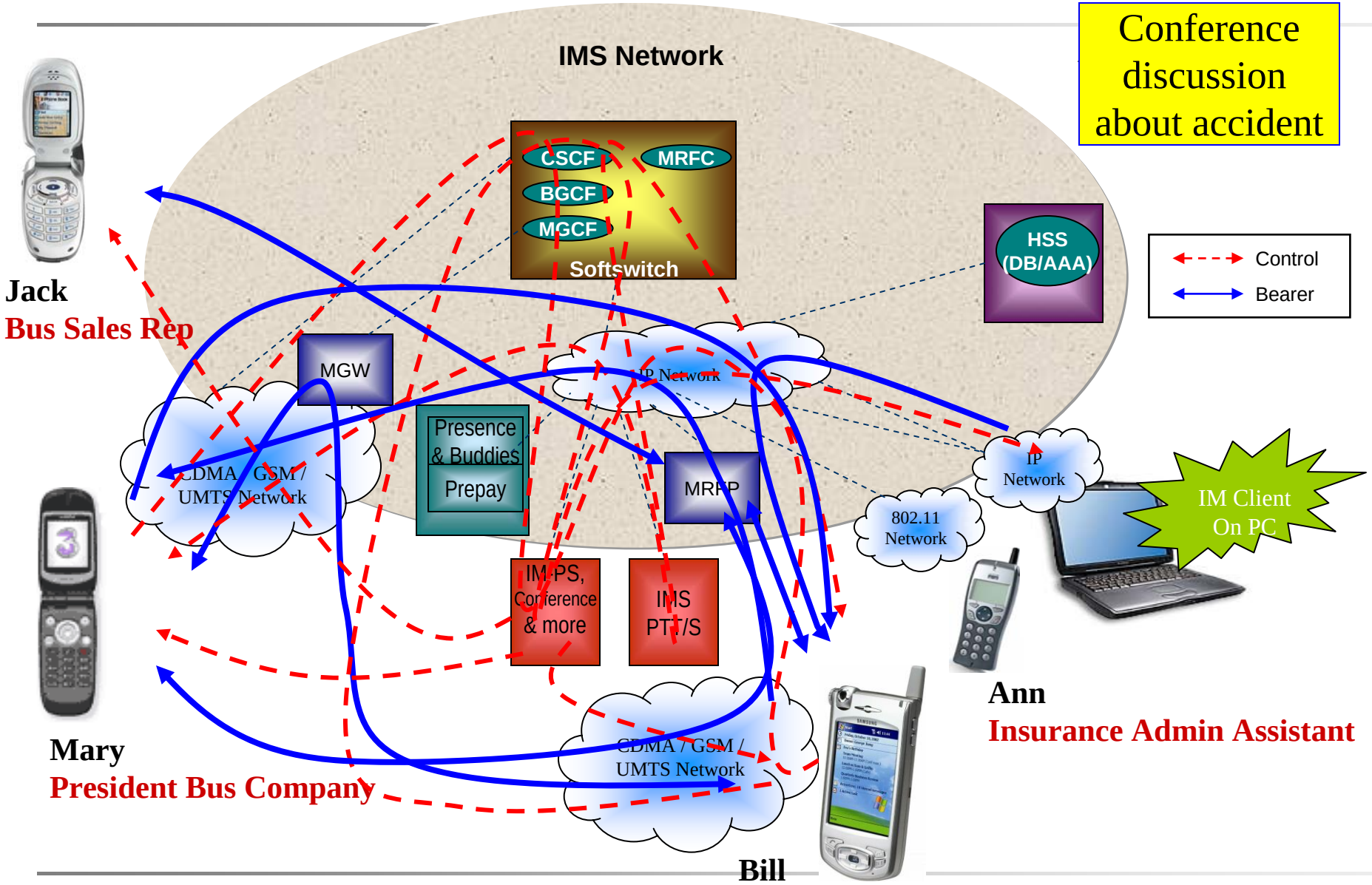
Signaling Entities

- HSS - Home Subscriber Server or "HSS Collective"
  - Consists of AAA and Databases
- CSCF - Call Session Control Function – 3 flavors
  - S-CSCF – Serving: Session control entity for endpoint devices
  - I-CSCF – Interrogating: Entry point to IMS from other networks
  - P-CSCF – Proxy: Entry point to IMS for devices
- BGCF - Breakout Gateway Control Function
  - Selects network to use for PSTN/PLMN interworking
- MGCF - Media Gateway Control Function
  - Controls MGW
- MRFC - Multimedia Resource Function Controller
  - Controls MRFP
- PDF - Policy Decision Function
  - Authorizes QoS requests
- AS - Application Servers – provides services and applications
  - Session Initiation Protocol (SIP) AS
  - Open Service Access (OSA) Service Capability Server (SCS) & OSA AS
  - AIN Interworking Server

Bearer Entities

- MGW - Media Gateway
  - Inter-works RTP/IP and PCM bearers
- MRFP - Multimedia Resource Function Processor
  - Provides conferencing, transcoding and announcements

Example - Insurance Claims Investigation



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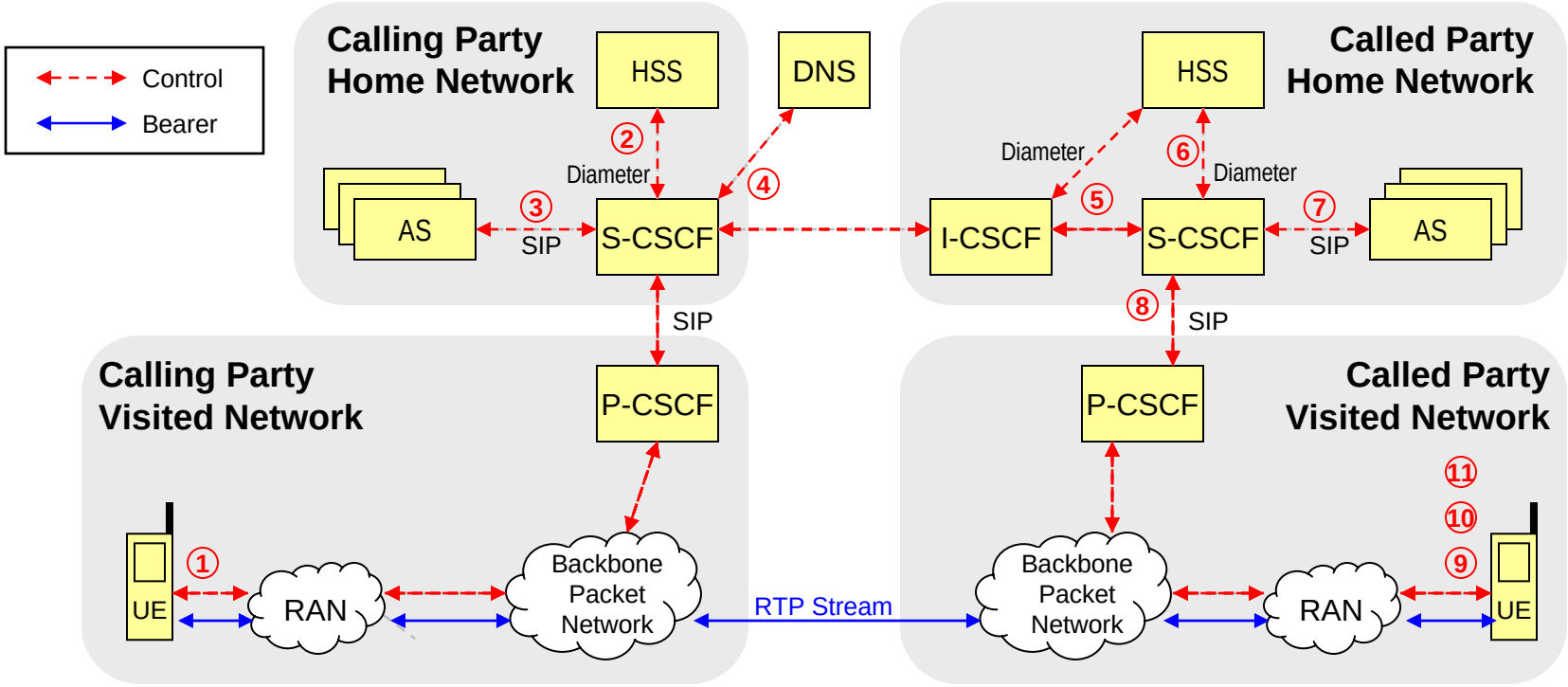
IMS Subscriber to IMS Subscriber high level call flow

① **Initiate SIP Invitation**
② **Retrieve Subscriber Profile (if needed)**
③ **Apply Service Logic**
④ **Retrieve Address of CLD Party Home Network and Forward INVITE.**
⑤ **Identify Registrar of CLD Party and Forward INVITE.**
⑥ **Retrieve Subscriber Profile (if needed)**
⑦ **Apply Service Logic**
⑧ **Forward INVITE to CLD Party**
⑨ **SDP Negotiation / Resource Reservation Control**
⑩ **Ringing / Alerting**
⑪ **Answer / Connect**



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Mobile-to-Mobile detailed call flow(1)

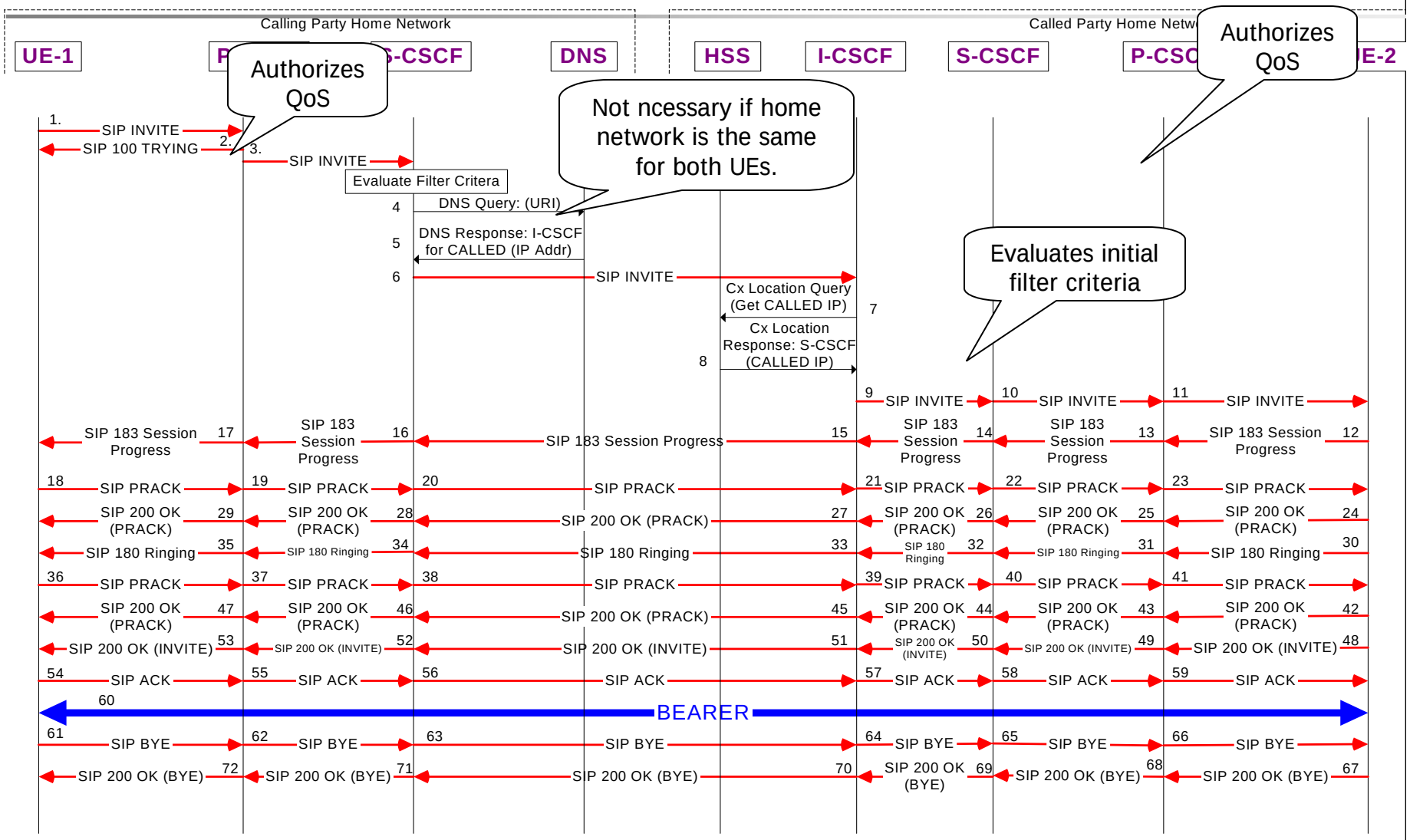

Figure A: SIP UE to SIP UE

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Mobile to Mobile detailed call flow (2)

- Both users are already attached to the network and registered.

1. UE-1 sends a SIP INVITE message to its Proxy CSCF(P-CSCF).
2. A SIP 100 Trying message is generated back to the UE. (This SIP 100 Trying message will not be shown throughout these call flows, but it is assumed that a SIP 100 Trying will be generated in reply to all SIP INVITE messages to avoid retransmission of the SIP INVITE.)
3. The P-CSCF determines the S-CSCF for UE-1.
4. The S-CSCF evaluates the Filter Criteria for UE-1 and then queries the DNS server to request the location information about the called party UE-2. (A DNS query is not necessary if UE2's home network is the same as UE-1's home network. In this case the S-CSCF after evaluating the filter criteria forwards the INVITE to a local I-CSCF and the procedure skips to step 6.)
5. The address of the I-CSCF for the UE-2 is returned from the DNS Server.
6. The SIP INVITE is passed to the I-CSCF for UE-2.
7. A request is made to the HSS to determine the location/profile/status of UE-2.
8. A reply is given from the HSS to the I-CSCF to identify the S-CSCF for UE-2.
9. The SIP INVITE is forwarded on to the S-CSCF for UE-2 which evaluates the service profile of the user and the initial filter criteria.
10. The S-CSCF forwards the SIP INVITE to the P-CSCF for UE-2. (The S-CSCF knows the P-CSCF for UE-2 based on UE-2's registration).
11. The P-CSCF forwards the SIP INVITE to UE-2.

Mobile to Mobile detailed call flow (3)

Step 12-17 A SIP 183 Session Progress message is sent back from UE-2 to UE-1. This SIP message may contain the SDP "answer" from the SIP INVITE SDP "offer".

Step 18-23 A SIP PRACK (PRovisional ACKnowledgement) is sent from UE-1 to UE-2. If an incomplete SDP "offer" was made in the initial INVITE from UE-1, then the PRACK can be used to make another SDP "offer".

Step 24-29 UE-2 responds with a SIP 200 OK to the previous SIP PRACK message. The message may include an SDP "answer" from the SDP "offer" from the previous SIP PRACK message.

Step 30-35 UE-2 may respond to the original SIP INVITE with a SIP 180 RINGING indicating that the called UE is ringing. This message traverses the same path back as the SIP INVITE took for delivery.

Step 36-41 UE-1 replies with a SIP PRACK to the previous SIP 180 RINGING.

Step 42-47 UE-2 sends a SIP 200 OK in response to the SIP PRACK.

Step 48-53 UE-2 also responds with a SIP 200 OK to the original SIP INVITE. This message traverses the same path back as the SIP INVITE and should contain the SDP "answer".

Step 54-59 The SIP ACK message is sent from UE-1 to UE-2. This Acknowledgement will contain the agreed upon resources for the session in the SDP.

Step 60 A Bearer Session is established between UE-1 and UE-2. The RTP session established here carries the negotiated media..

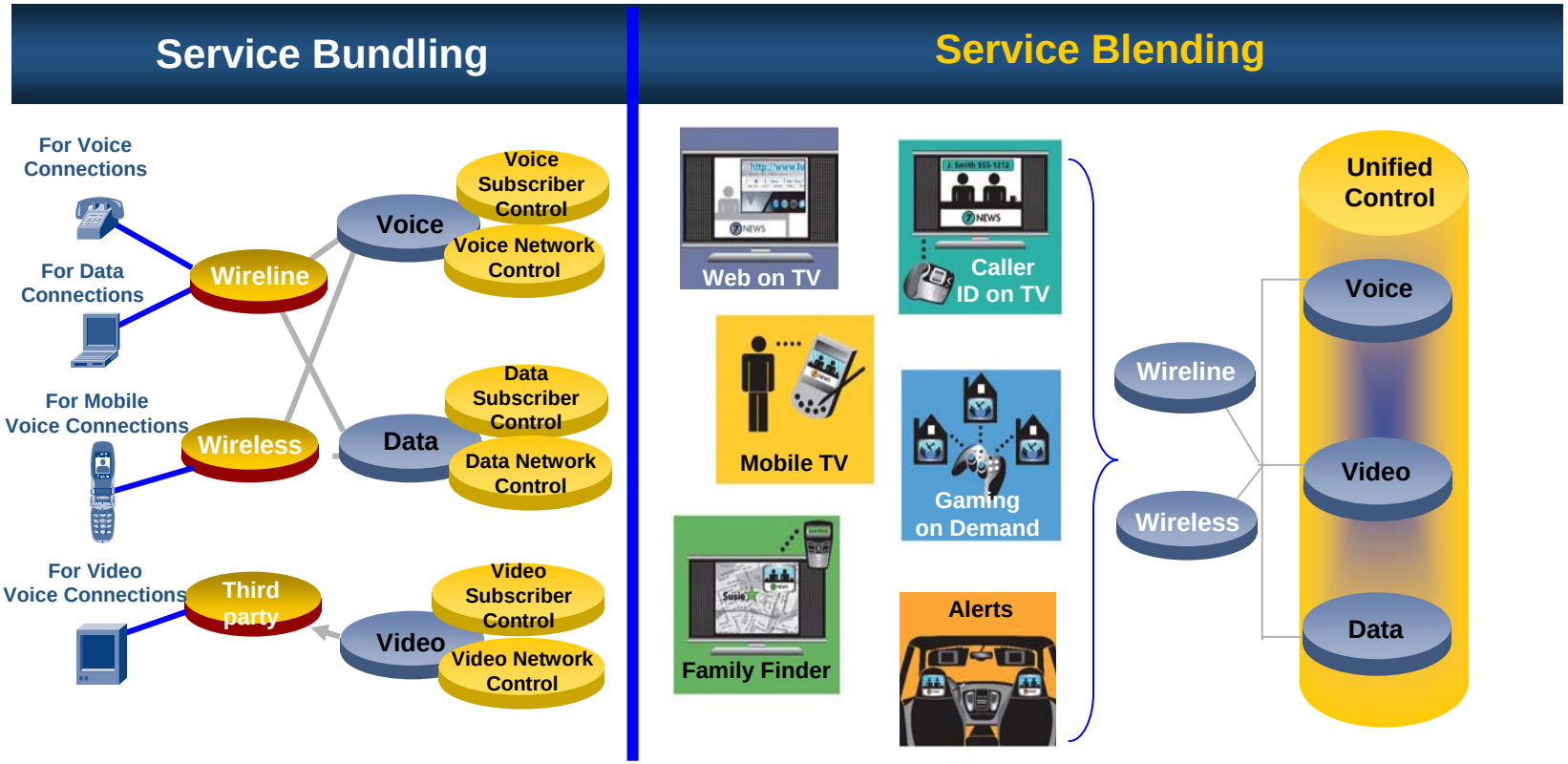
Step 61-66 A SIP BYE message is sent by either party, UE-1 or UE-2. In this case UE-1 sends the SIP BYE to UE-2 to terminate the call.

Step 67-72 UE-2 responds with a SIP 200 OK to UE-1 and the session is terminated.

Service Bundling vs. Service Blending

Service bundling offers unified ordering and billing for otherwise separate services.

Service Blending enables different services to control one another, providing new services



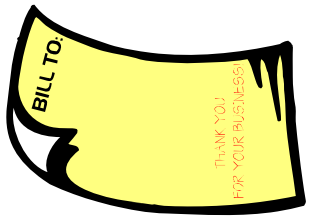
Example: Separate Services

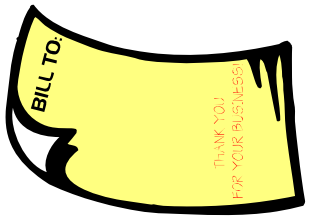
Phone Service

TV Service

Separate Bills

No service integration

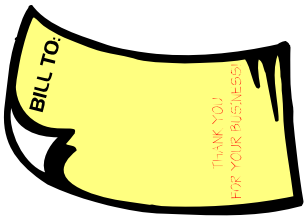




Example: Simple Service Bundling

Phone Service

TV Service



Single Bill

No service integration
(still independent services)

No cost reduction

No true differentiation
(can easily be copied)

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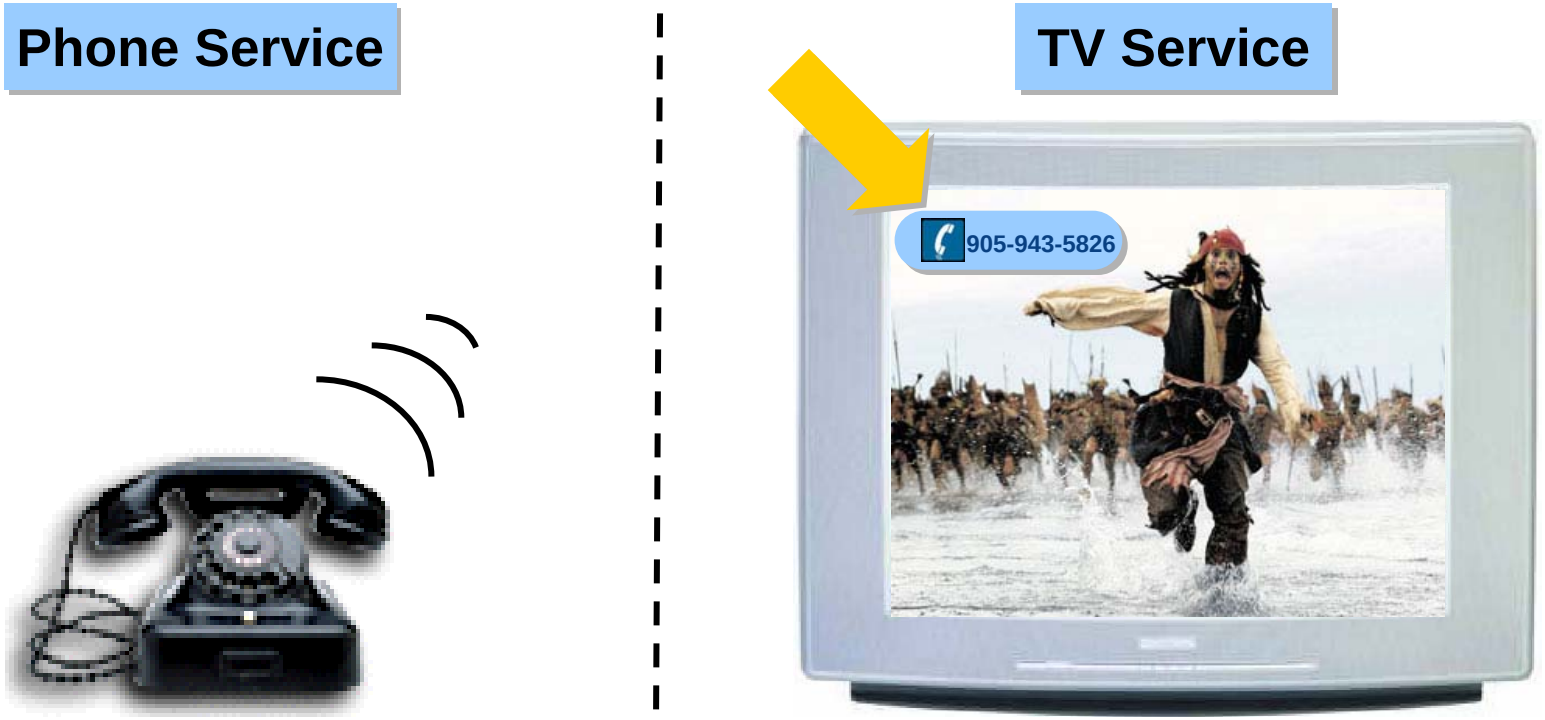
Example: Enhanced Service Bundling



Services are overlaid (e.g. display of Caller ID on TV)

But: Services still do *not* control each other.

Example: True Service Blending

Phone Service

TV Service

Services interwork and control one another, e.g.

- Call disposition via TV Remote Control,
- TV content is automatically recorded during a call.

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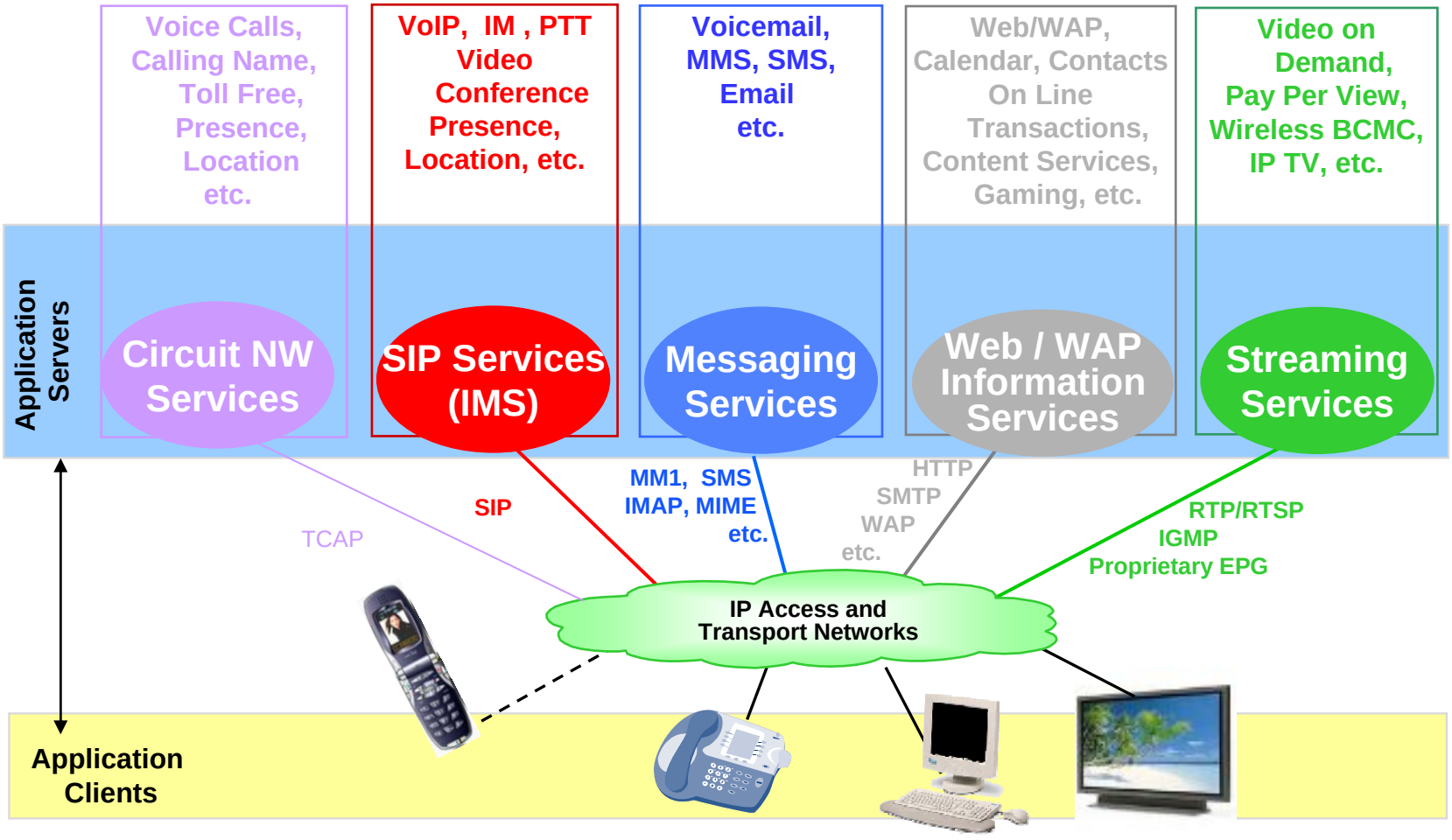
Service Infrastructures - Unblended



Carriers are deploying multiple architectures for delivering services

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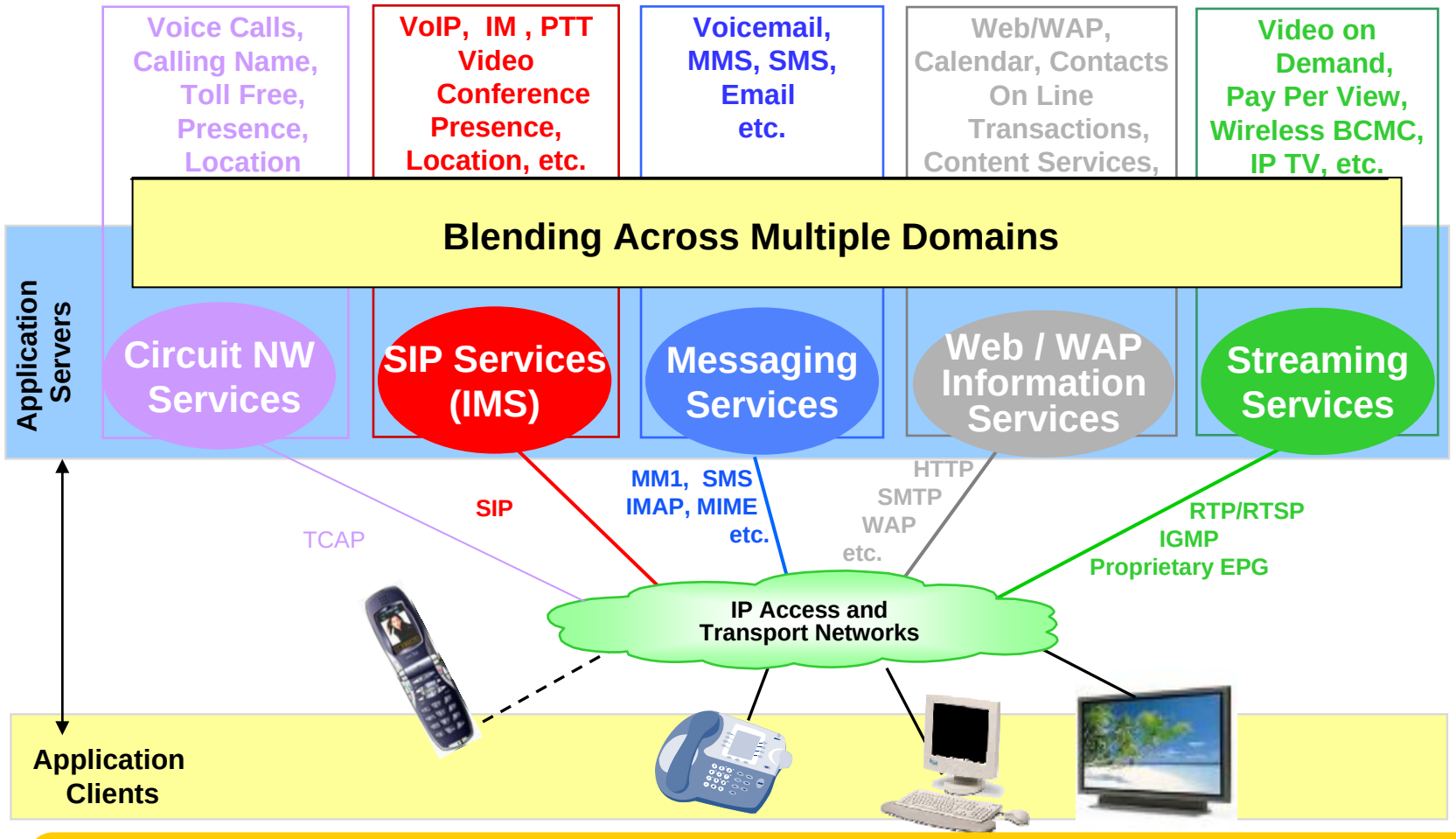
Service Infrastructures - Blended



This provides opportunities to create blending across multiple domains.

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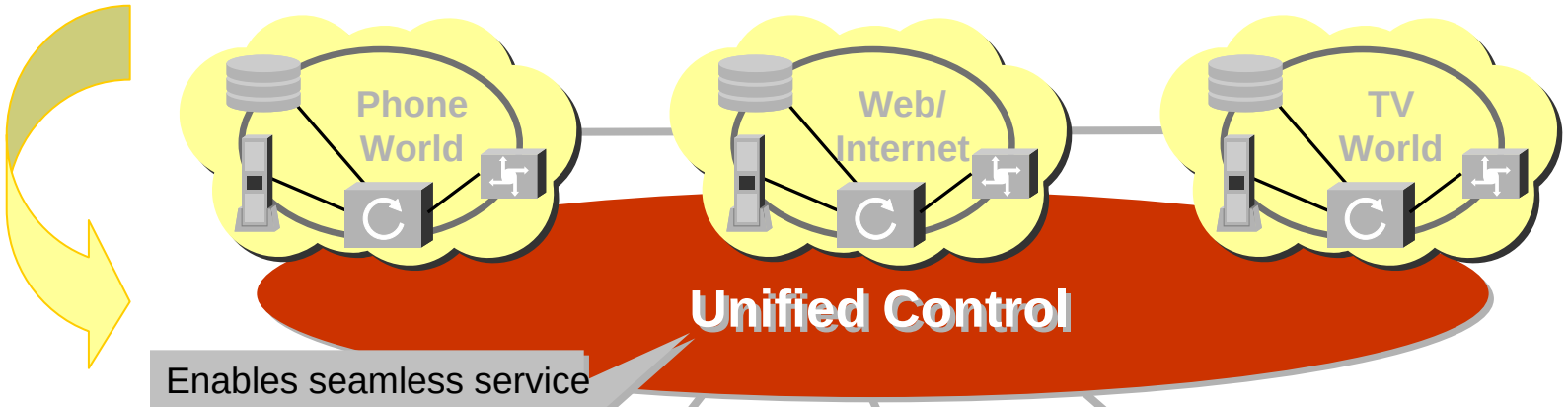
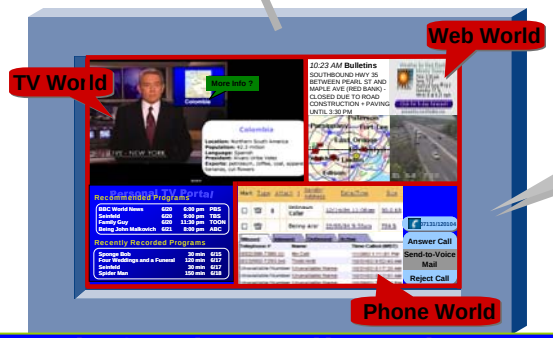
How is blending achieved?

Through the creation of a services "ecosystem" that provides unified control across multiple service domains



Enables seamless service control across networks; supports data federation and content syndication.



Enables truly blended services that go beyond simple service bundling

IMS provides a framework for blending through the use of SCIM…

Service Capability Interaction Manager

SCIM Definition

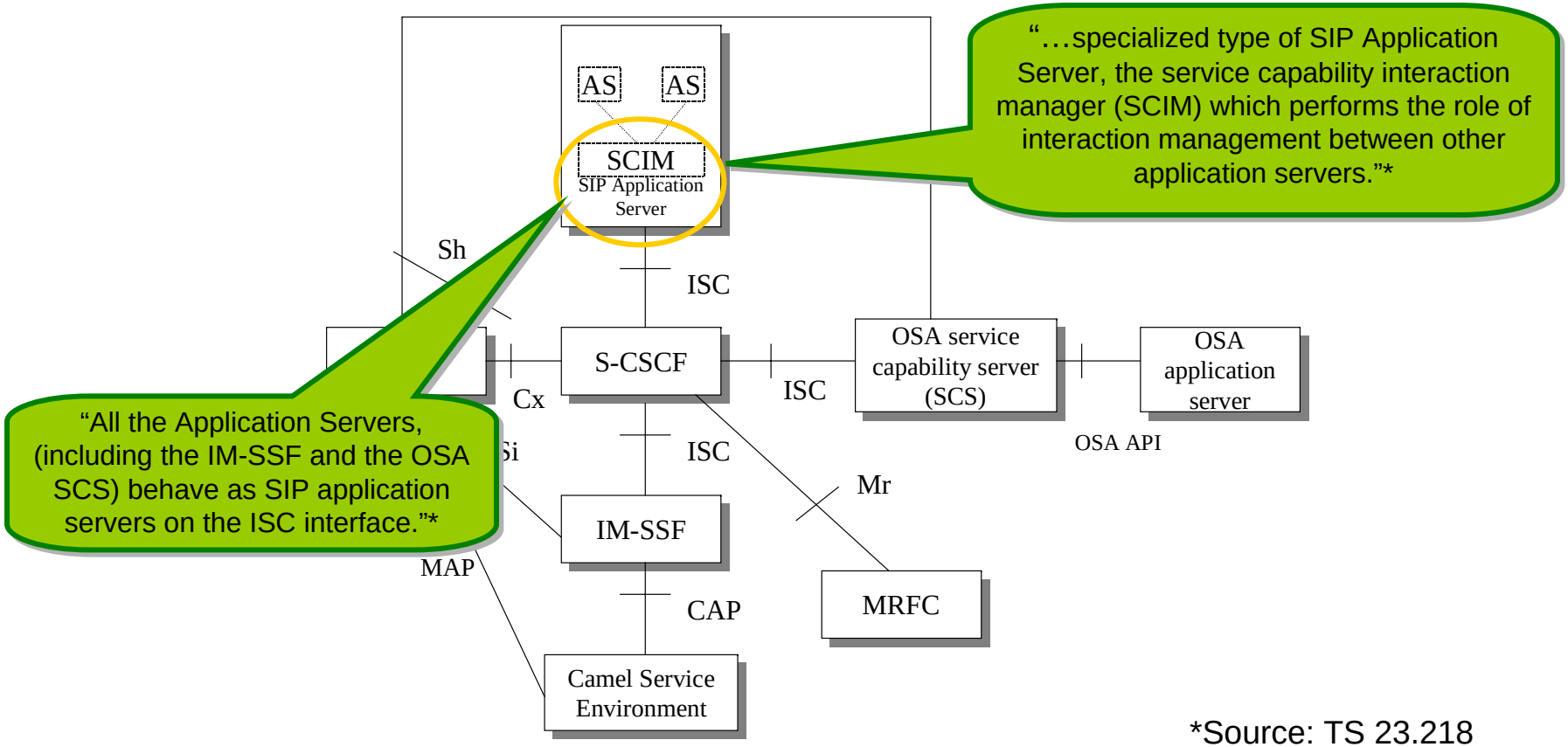


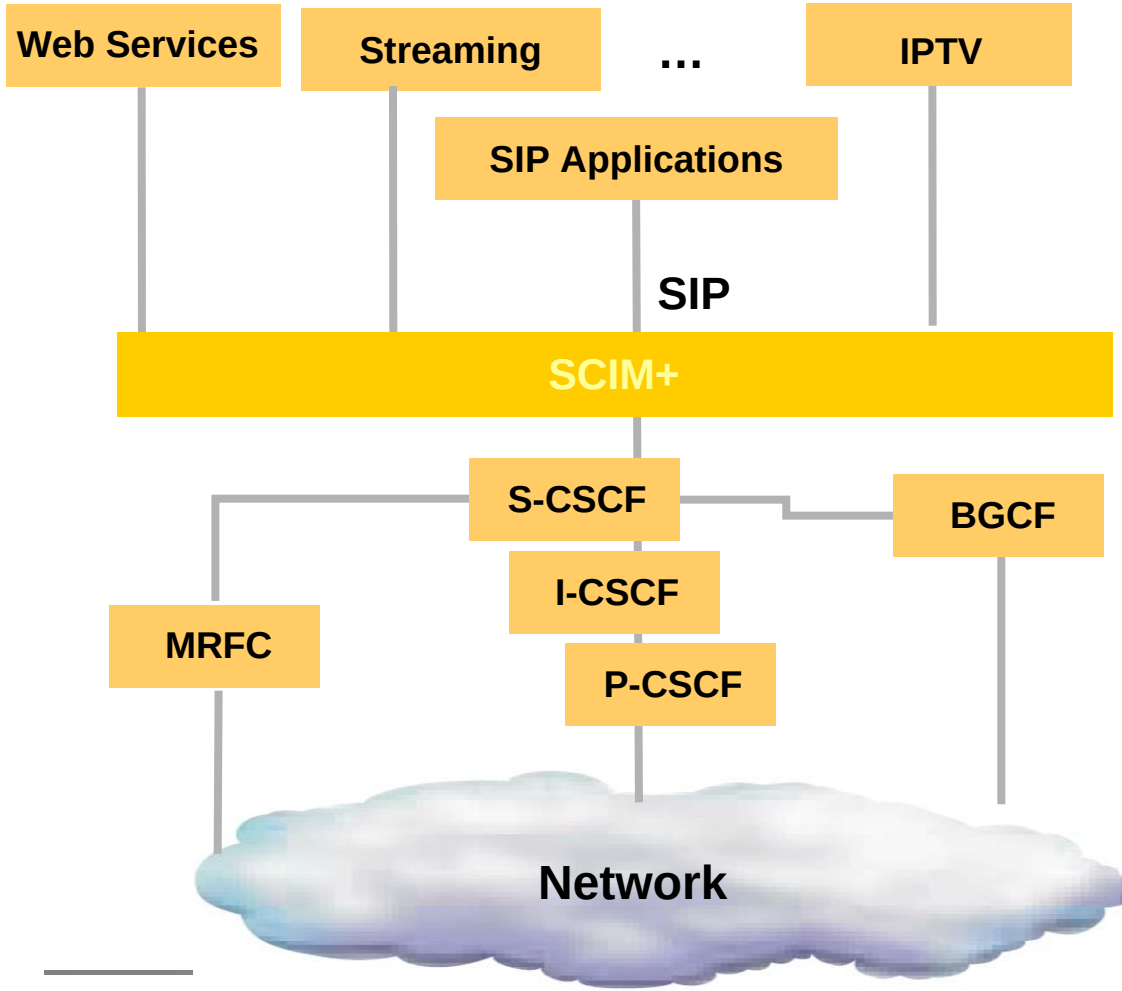
Figure 5.1 1 – 3GPP TS 23.218

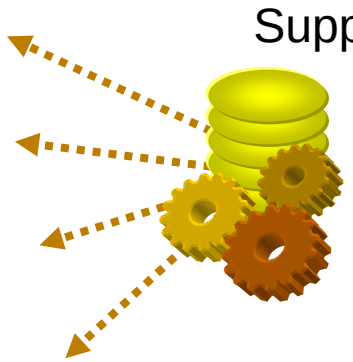
*Source: TS 23.218
* See also: TS 23.2002

3GPP is not expected to further define the SCIM since it is in the application layer.

Kicking It Up a Notch - SCIM+

Network Architecture





Support Systems & Databases (e.g. HSS, DNS, Presence, Charging)

Controlling interactions

- Among Application Servers
- Among Multiple sessions
- To Multiple or Diverse CPEs

Blending of services across domains

- Blend with Presence, Location, etc.
- Blend with Web Servers, messaging
- Blend with Session Context
- Blend with IT or Desktop Applications

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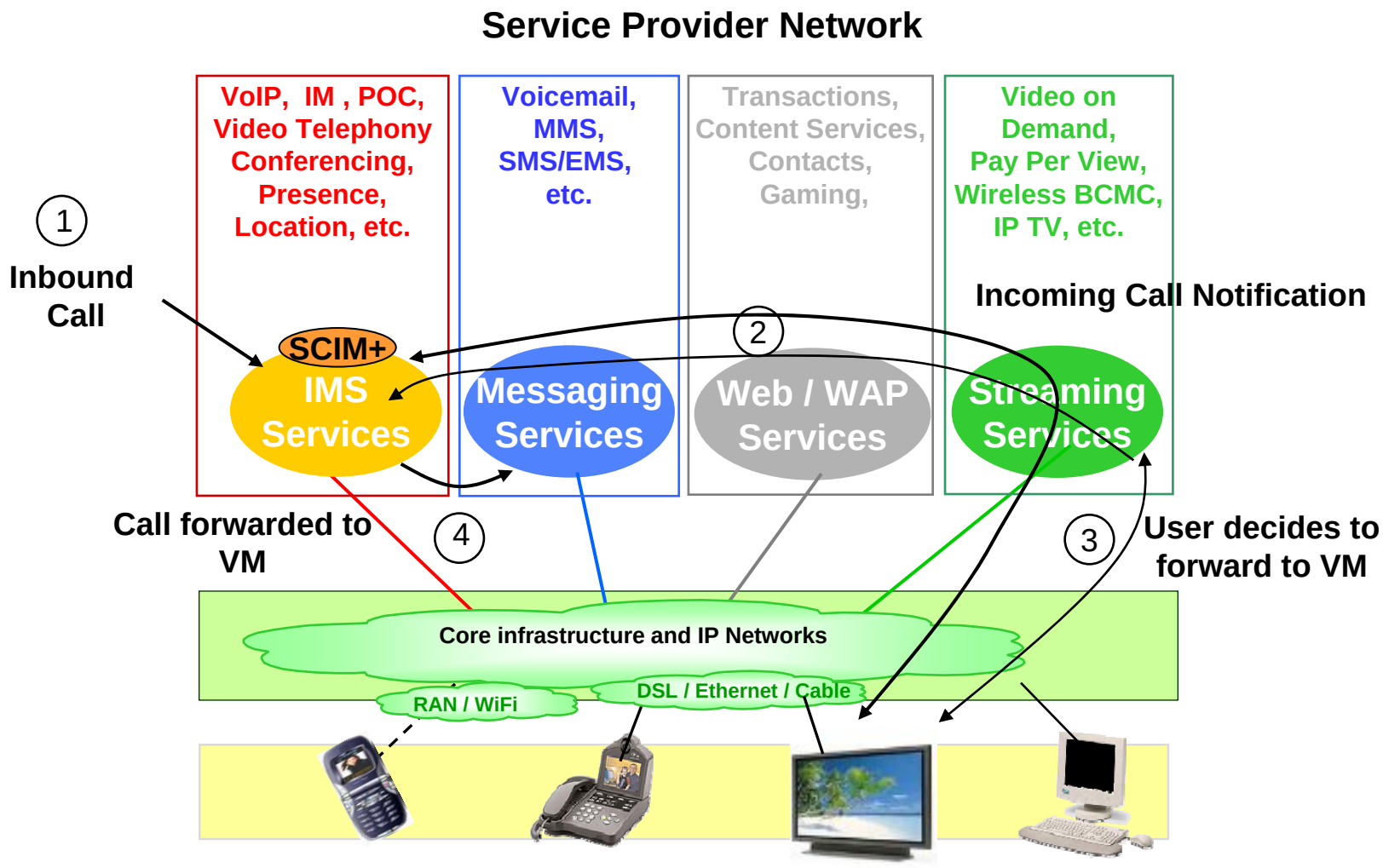
Blended Service Example

Call Routing and TV Service



Blending of Voice and TV Services

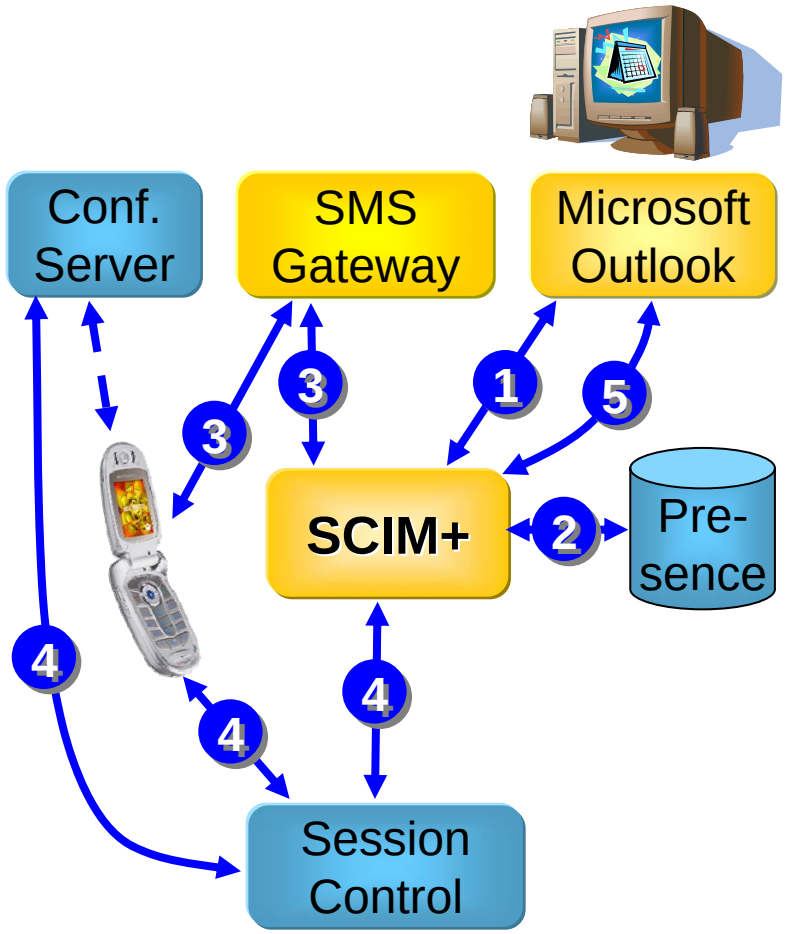
Another Example

Outlook Calendar Notifications

Use Case: Receive conference call reminder on cell phone with option for automated call placement.

Call Flow Example:

1. Outlook triggers alert for “conference call” via HTTP or Web Services interface
2. SCIM+ checks presence status of user (i.e. is cell phone on or off?)
3. If cell phone on, SCIM+ sends notification (e.g. via SMS), adding option for automate call placement.
4. If user selects to be placed on conference call, SCIM+ bridges user into conference
5. SCIM+ notifies Outlook via HTTP or Web Services interface to dismiss future reminders.



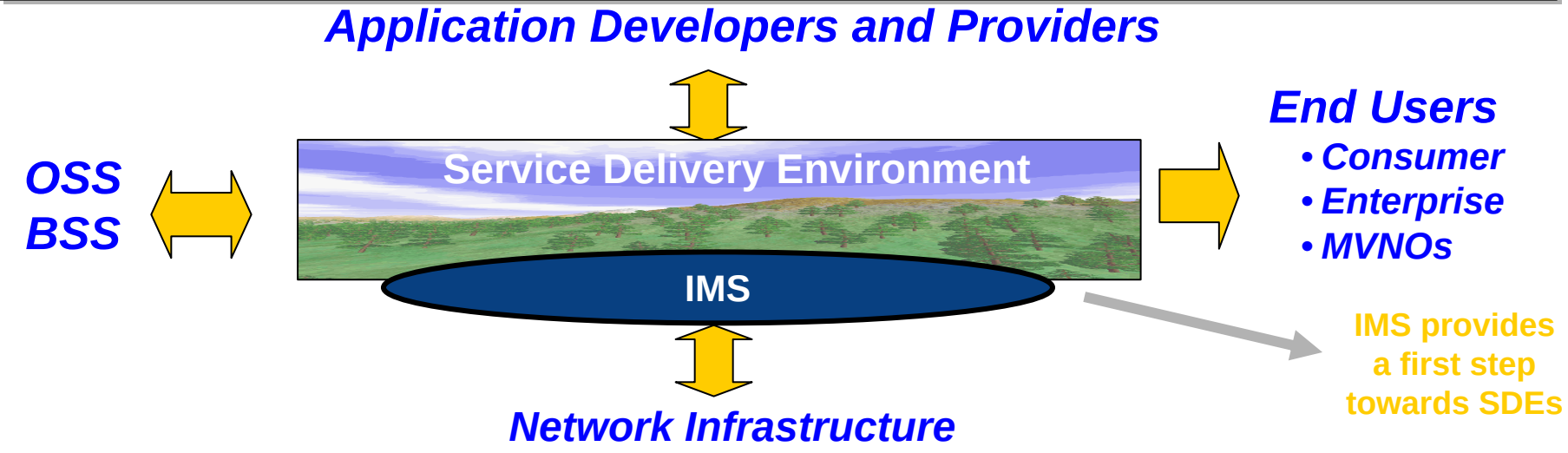
Beyond IMS…Building an Ecosystem

IMS, SDPs and SDEs – Some Soft Definitions

SDP → Service Delivery Platform → A misnomer → Not a Platform but rather a set of functions traditionally used by IT vendors for creating Business Processes and Web services.

SDE → Service Delivery Environment → A full ecosystem for the rapid introduction of new services:

- Brings together network services with SOA based Web Services
- Provide seamless integration into BSS/OSS
- Enable the large ecosystem of IT application developers to write new services



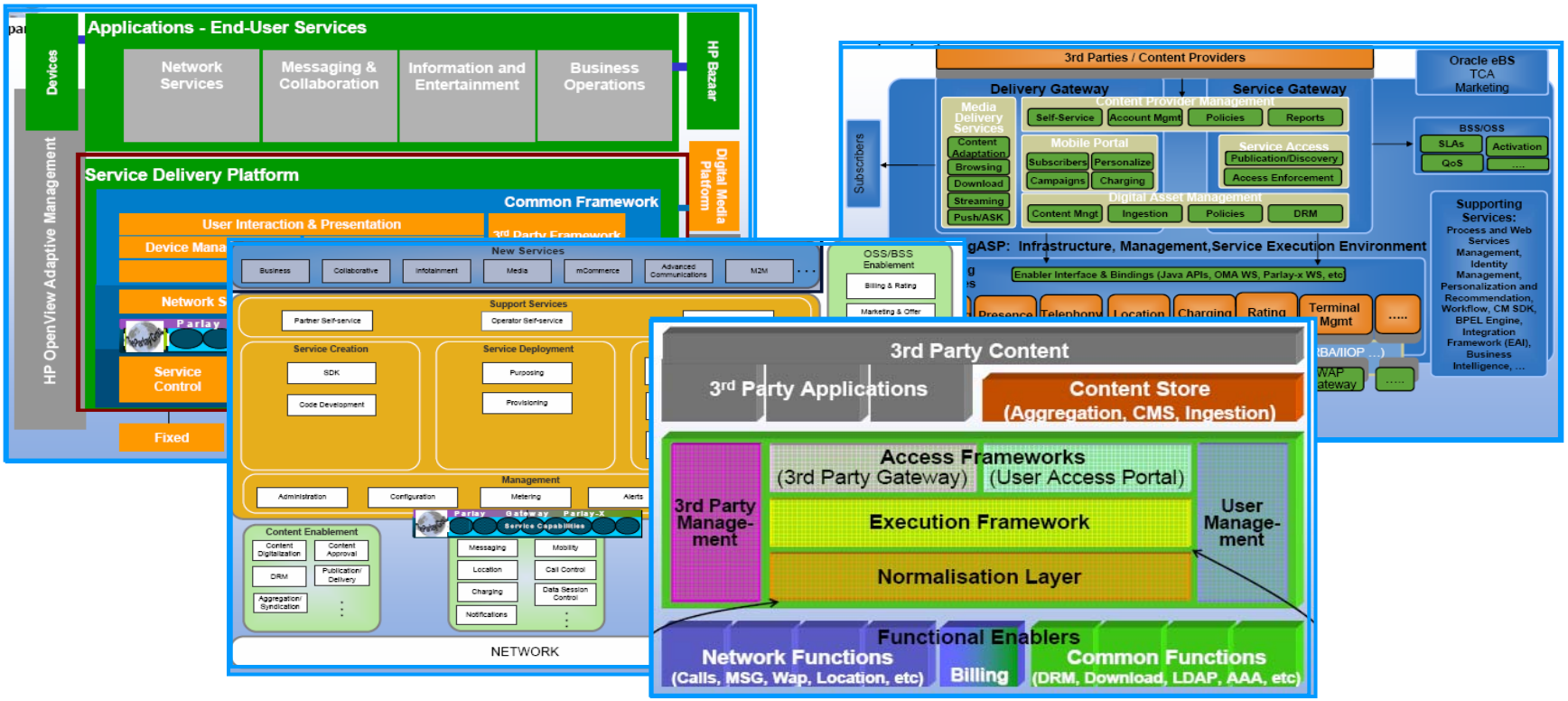
A full function SDE spans the capabilities of traditional telecom vendors and traditional IT vendors.

Beyond IMS…

Challenges

No standards

Lack of alignment on scope and components



Hard definitions are hard to get…still an evolving area…

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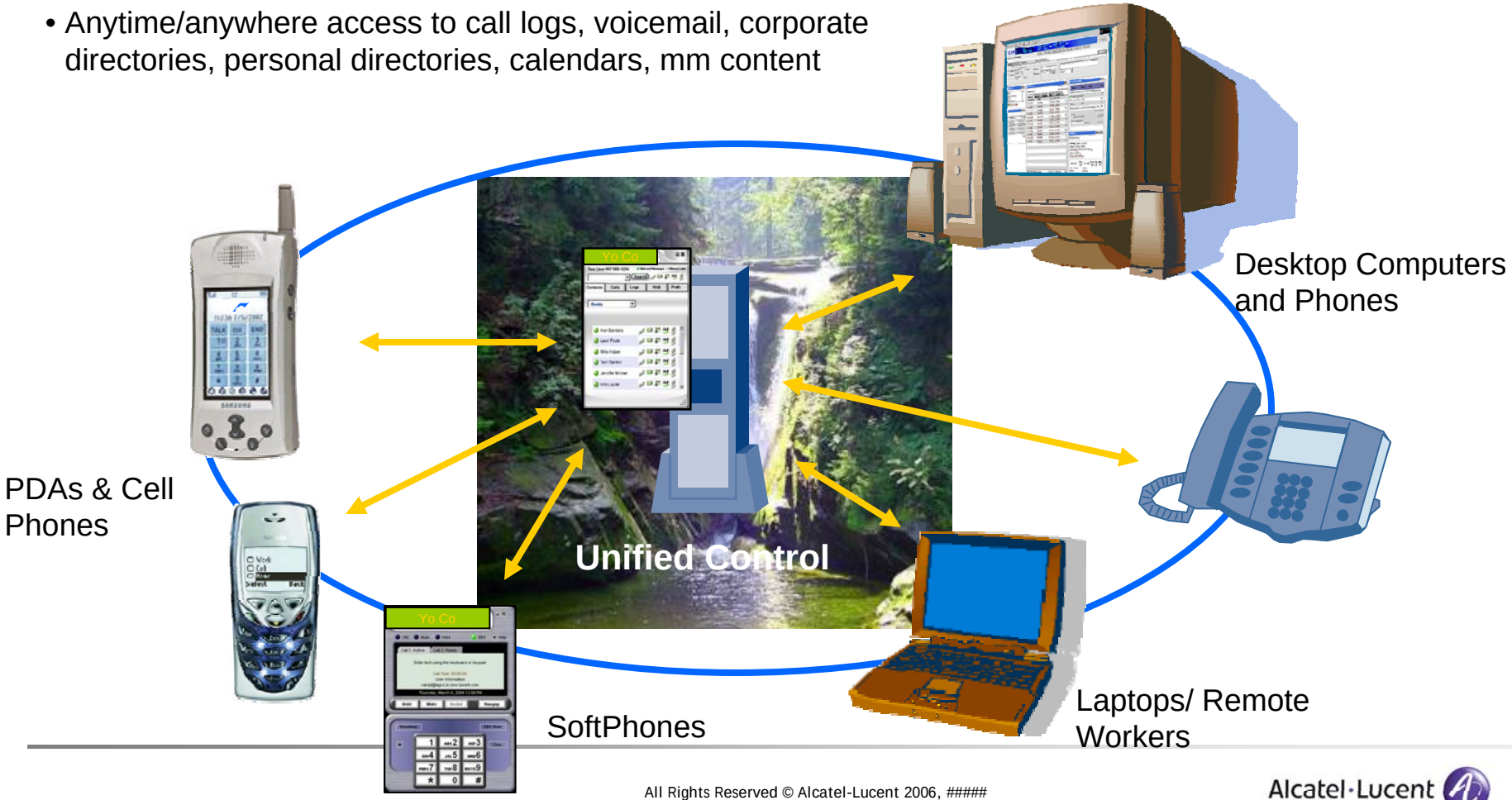
Beyond IMS…A View of Nirvana???

Unified Communications – Anywhere, Any Device, Anytime

- Goes beyond just voice to include video, email, IM and future applications controlling and interacting with one another
- Communication sessions are invoked through a variety of devices– real time.
- Anytime/anywhere access to call logs, voicemail, corporate directories, personal directories, calendars, mm content



Summary

Networks that in the past were separate are beginning to converge:

- Web, telephony, TV are all coming together.

This coming together of networks allows for different levels of "service convergence":

- The first step was to offer service *bundling* but this is limited.
- Service *blending* on the other hand can offer real differentiation to Service Providers.

Blending relies on unified control across multiple domains:

- IMS is a starting place:
  - Offers an open framework for such unified control through the separation of the session layer from the application layer and the use of the SCIM.

The development of full "Service Ecosystems", through SDEs, is the next step forward in the world of next generation networks.

Acknowledgements

Markus Hofmann

Rick Hull

Anne Lee

Doug Varney

And many others in Bell Labs/Alcatel-Lucent working in this area.