Перспективен техно-бизнес модел за бъдещи комуникации

(*публична академична лекция*)

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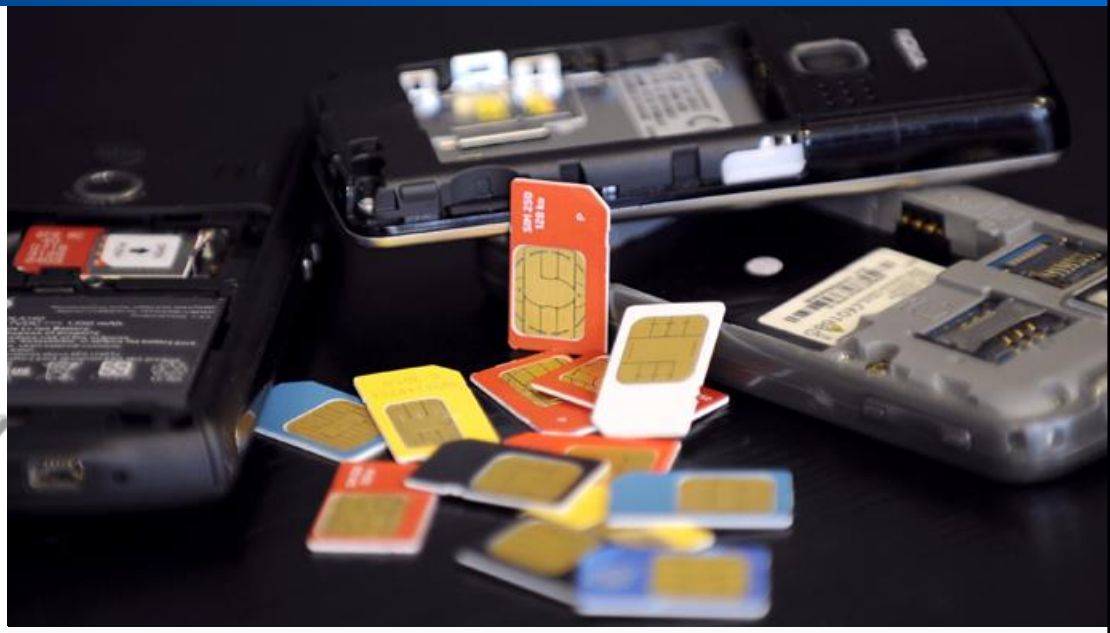
Introduction



Outline

- Techno-business models:
  - **Subscriber**-Based Model (**SBM**)
  - **Consumer**-Based Model (**CBM**)
- CBM technological enablers / solutions:
  - 3P-AAA & 3P-C&B
  - WBCs & ADA
  - ICC
- Conclusions

Introduction: Main Points

Context

- Techno-business model for future wireless mobile communications
- **Important questions** in the process of **directing the evolution** of 'Always Best Connected and best Served' (**ABC&S**) in future generations of wireless communications are:
  - What business models are feasible?
  - What kind of generic business models would be attractive to stakeholders and **would drive this vision**?
  - What are the technical implications of any newly proposed business model?

Introduction: Main Points (cont.)

Core Idea:

A different techno-business model from the evolving legacy one.

This and some key technical innovations required to supported it are outlined.

Bottom Line:

The way wireless services, especially the wireless access service component is supplied, should be founded on a **consumer-based** structure rather than a subscriber-based structure.

Introduction: Main Points (cont.)

A new generic techno-business model can result from an **infrastructural re-think** on the way Authentication, Authorization and Accounting (**AAA**) service is supplied,

and

that this is key to a healthy future communications' evolution.

Introduction: Some Terms

1. Consumer-Based techno-business Model (CBM)
2. Subscriber-Based techno-business Model (SBM)
3. **Subscriber:** has an account(s) and a mobile terminal (MT) number(s) tied to a particular ANP.
   - This ANP is often called the home access network provider, HANP
   - In mobile phones, it's possible to have different U/SIM cards, equivalent to having a number of subscriber contracts with different ANPs.
     - NOT user friendly;
     - MT numbering is under the control of HANP, even where number portability is facilitated.
4. **Consumer:** Obtains services of the access network (AN) as and when mobile user (MU) wants.
   - Much like other consumer services … ***Shopping analogy***
   - MU owns their (MT) numbers (e.g. IPv6 addresses) as of right
     - NOT subject to any 'subscriber agreement'. Does not have a subscriber contract with any ANP.
   - Addresses to be purchased by MU, e.g. with purchase of personal device (mobile phone, U/SIM card, tablet, laptop, etc.)

Techno-Business Models: Main Actors

- **Mobile User (MU)**
  - Primarily the seeker of ABC&S
  - Requests different types of services from different types of Service Providers (xSPs) to be provided through multiple service-specific ABC&S wireless access connections which best match MU's profile-role
- **Home Access Network Provider (HANP) / Foreign Access Network Provider (FANP)**
  - Provides access network infrastructure and transport medium
  - Legacy entities
    - Simply called 'ANPs' in CBM

Techno-Business Models: Main Actors (cont.)

- **(Mobile) Service Provider (xSP)**
  - **Ordinary SP** - providing services to MU directly, or indirectly through VASP
    - Content Provider (CP) - provides downloadable content, e.g. music files, video clips, MPEG movies, eLectures, eBooks, etc.
    - Application Service Provider (ASP) - provider (and may be also developer) of user applications such as VoIP, teleconferencing, eCommerce, eEducation, eGovernment etc.
    - Commercial Service Provider (CSP) – airlines, travel agencies etc.
  - **Value-Added Service Provider (VASP)** - providing additional services, e.g.
    - Service deployment and adaptation to user/terminal/network profiles
    - Special service configurations
    - Transparent network and MT reconfiguration
    - Service adaptation to satisfy special service requests
    - etc.

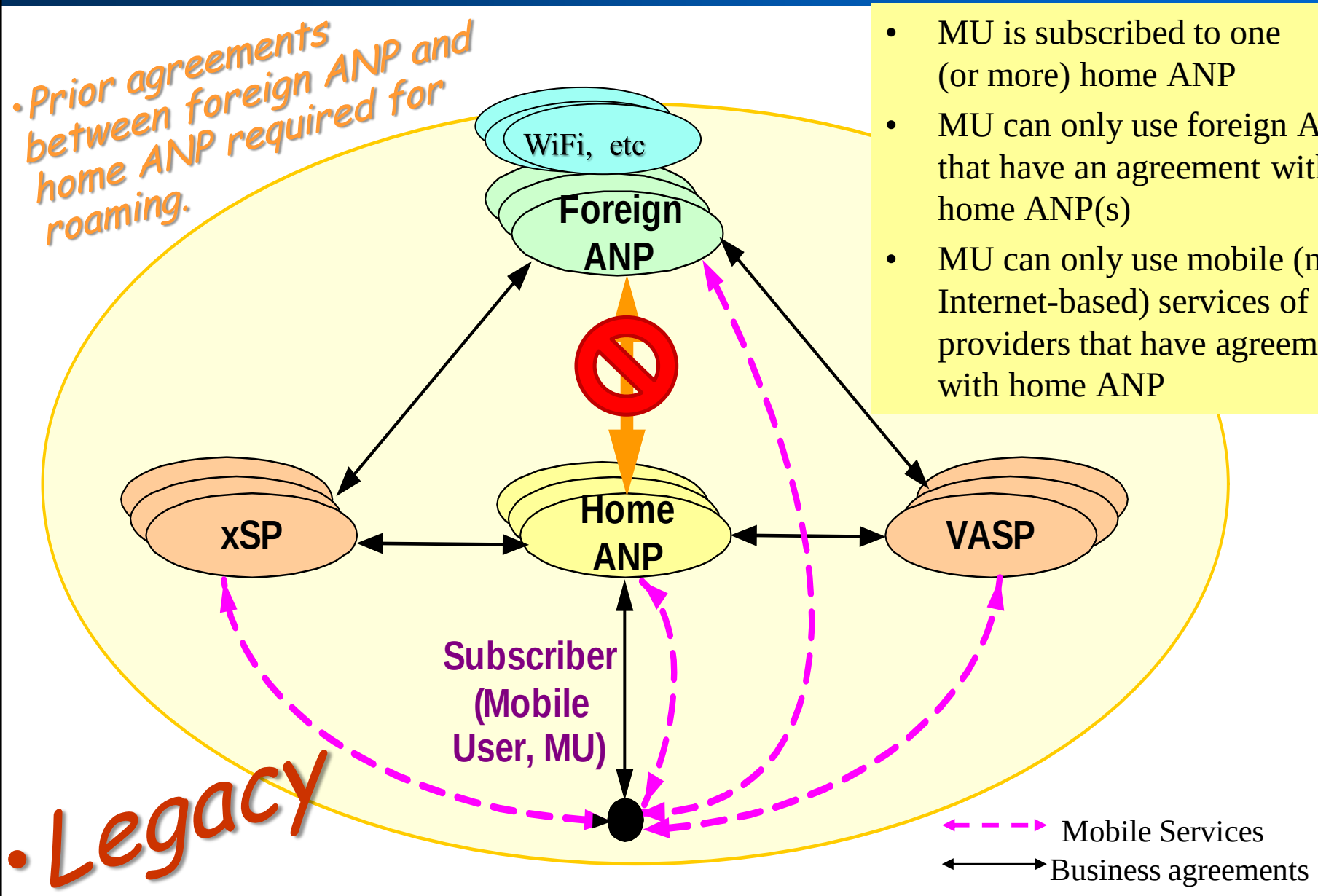
Techno-Business Models: Main Actors (cont.)

NEW SP Actors in CBM:

- **3P-AAA-SPs**
  - Provides authentication, authorization and accounting (AAA) of both MU (wishing to use xSP's services) and xSP (wishing to offer services over ANP networks)
- **WBC-SPs**
- **ICC-SPs**
- *and more*

SBM techno-business model

- MU is subscribed to one (or more) home ANP
- MU can only use foreign ANPs that have an agreement with home ANP(s)
- MU can only use mobile (non-Internet-based) services of providers that have agreement with home ANP



SBM: Roaming Prices Example 1
(Mtel Bulgaria)

Цени, валидни от 15.06.2017

Зони	Изходящо повикване към ЕС (включително България)	Изходящо повикване извън ЕС	Входящо повикване	SMS	Цена на MB
Зона 1 - Страни в ЕС / ЕИЗ	По национален тарифен план – цена за гласово повикване към други национални мобилни/ фиксирани мрежи при спазване на политиката за справедливо ползване, част от ОУ	6,99 лв.	0,00 лв. при спазване на политиката за справедливо ползване, част от ОУ	По национален тарифен план - цена за SMS към други национални мобилни мрежи при спазване на политиката за справедливо ползване, част от ОУ	По национален тарифен план при спазване на политиката за справедливо ползване, част от ОУ
Зона 2 - Страни извън ЕС	6,99 лв.	6,99 лв.	2,99 лв.	1,29 лв.	24,48 лв.

Source: www.mtel.bg/rouming-tarifen-plan-eurotariff

SBM: Roaming Prices Example 2

(Mtel Bulgaria)

tel

Пакети Планове Телевизия Интернет Устройства Повече от Мтел За Мтел Помощ Mtel Sport EN

Mtel WORLD TRAVELLER	Изходящо обаждане (към България, страната на пребиваване, Европа)	Изходящо обаждане (към всички останали държави)	Входящо обаждане	Изходящ SMS	Цена за 100 KB/ Цена на MMS за 100 KB
Зона 1 – Препоръчителни мрежи	0,99 лв.	5,99 лв.	0,49 лв.	0,59 лв.	0,99 лв.
Зона 2 – Препоръчителни мрежи	2,59 лв.	5,99 лв.	1,49 лв.	0,59 лв.	1,49 лв.
Зона 3 – Препоръчителни мрежи	5,99 лв.	5,99 лв.	1,99 лв.	0,79 лв.	1,69 лв.
Зона 1 – Други мрежи	1,99 лв.	6,99 лв.	0,89 лв.	0,89 лв.	1,29 лв.
Зона 2 – Други мрежи	3,59 лв.	6,99 лв.	1,79 лв.	0,89 лв.	1,79 лв.
Зона 3 – Други мрежи	6,99 лв.	6,99 лв.	2,49 лв.	0,99 лв.	1,99 лв.

Source: www.mtel.bg/rouming-tarifen-plan-mtel-world-traveller

SBM: Roaming Prices Example 2 cont.

(Mtel Bulgaria)

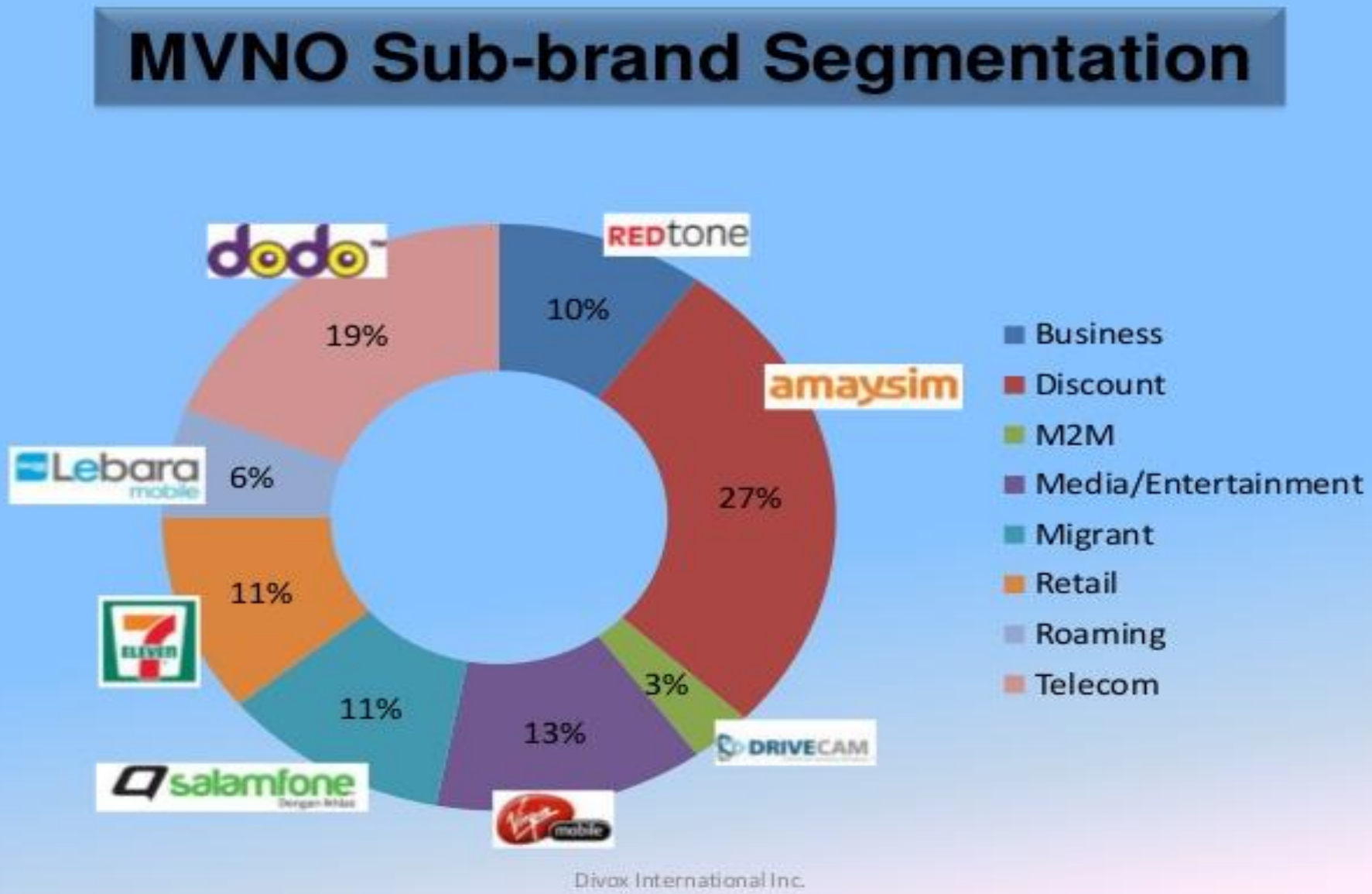
tel Пакети Планове Телевизия Интернет Устройства Повече от Мтел За Мтел Помощ Mtel Sport

Държава	Препоръчителни мрежи	Останали мрежи
Зона 1		
Австрия	A1	Hutchison Drei Austria T-Mobile
Белгия	Orange	Belgacom (Proximus) BASE Company
Великобритания	Vodafone	O2 T-Mobile Orange Hutchison 3G
Германия	D2 Vodafone	telekom.de (T-mobile) E-Plus (1800) O2 (Germany)
Гибралтар		GIBTEL

Source: www.mtel.bg/rouming-tarifen-plan-mtel-world-traveller

SBM: Global Mobile Network Operators' Strategy

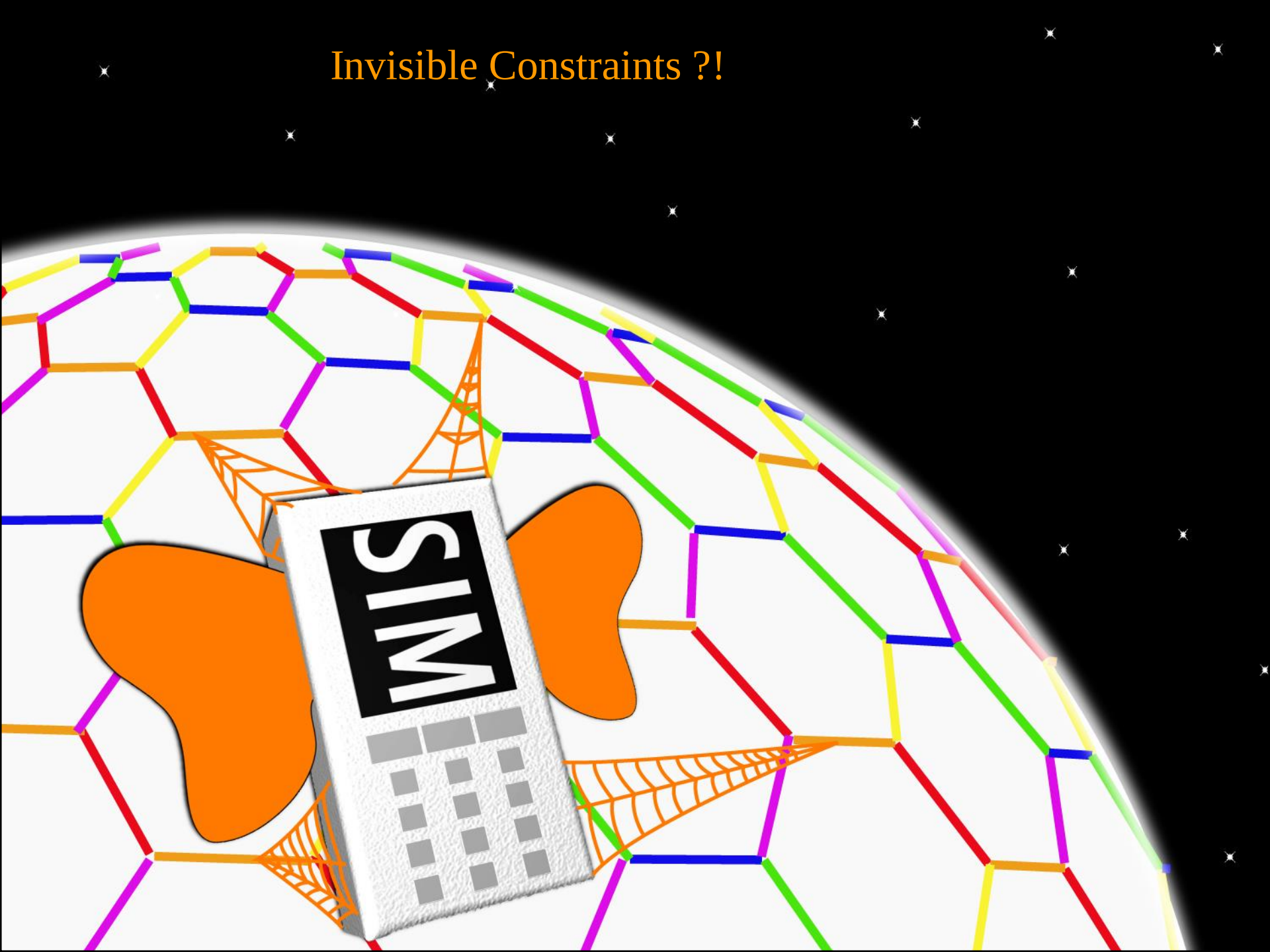
SBM: Virtual Mobile Network Operators' Strategy



SBM: General Characteristics

- Legacy business model
- ANP-centric
- Reflects the thrust of present trends
- Key idea: **User is a *subscriber***
- 1 itemized bill through HANP *(per U/SIM card)*
- Prior roaming agreements between FANP and HANP required
- Business agreements between registered xSPs and ANPs
    - That the AN will simply be section of service independent transport pipes is simply a pipe-dream !!!

Invisible Constraints ?!



SBM: Down-side

Dominant network rewarding !

- Inimical to new ANP entrants,
  - Who would require
    - Infrastructure (comprehensive and fully tested)
    - FANP and xSP agreements (slow & time consuming process)
    - Subscribers
    - And more …

  before it is possible to start offering services

Brake on fast deployment and flexible provision of new xSP services

- For similar reasons
- Significant insecurity for / barrier to new xSP entrants

SBM: Down-side (cont.)

Slow, constrained ABC&S evolution

- Of its nature
- MU must be a subscriber to an ANP before may access their ABC&S offerings, and will find themselves constrained to these.

Signalling overheads set to grow endless

- Standardization? Overload?
- Proliferation of proprietary, industrial standards
  - Even more rarefied ANP marketplace – antithesis of openness, etc.
  - Dominance enhancement trend of dominant ANPs

Trend from SBM to CBM

Legacy

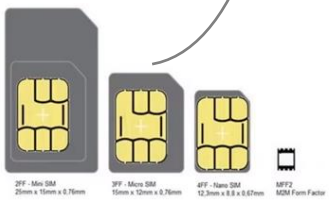
SBM

Subscriber-centric

Mobile devices with multiple SIM slots

Multiple SIMs adapter cases (SIMore)

Bluetooth multiple SIMs adapters (SIMore)



Mobile devices with eSIM card

Future

CBM

Consumer-centric

User-friendly & user-driven ABC&S

Full anytime-anywhere-anyhow portability

Level playing field

Zero-cost international roaming

New telecommunications services markets

Global Pervasive

CBM-UCWW

NOT without Standardization

Co-Existence

SBM moving towards CBM

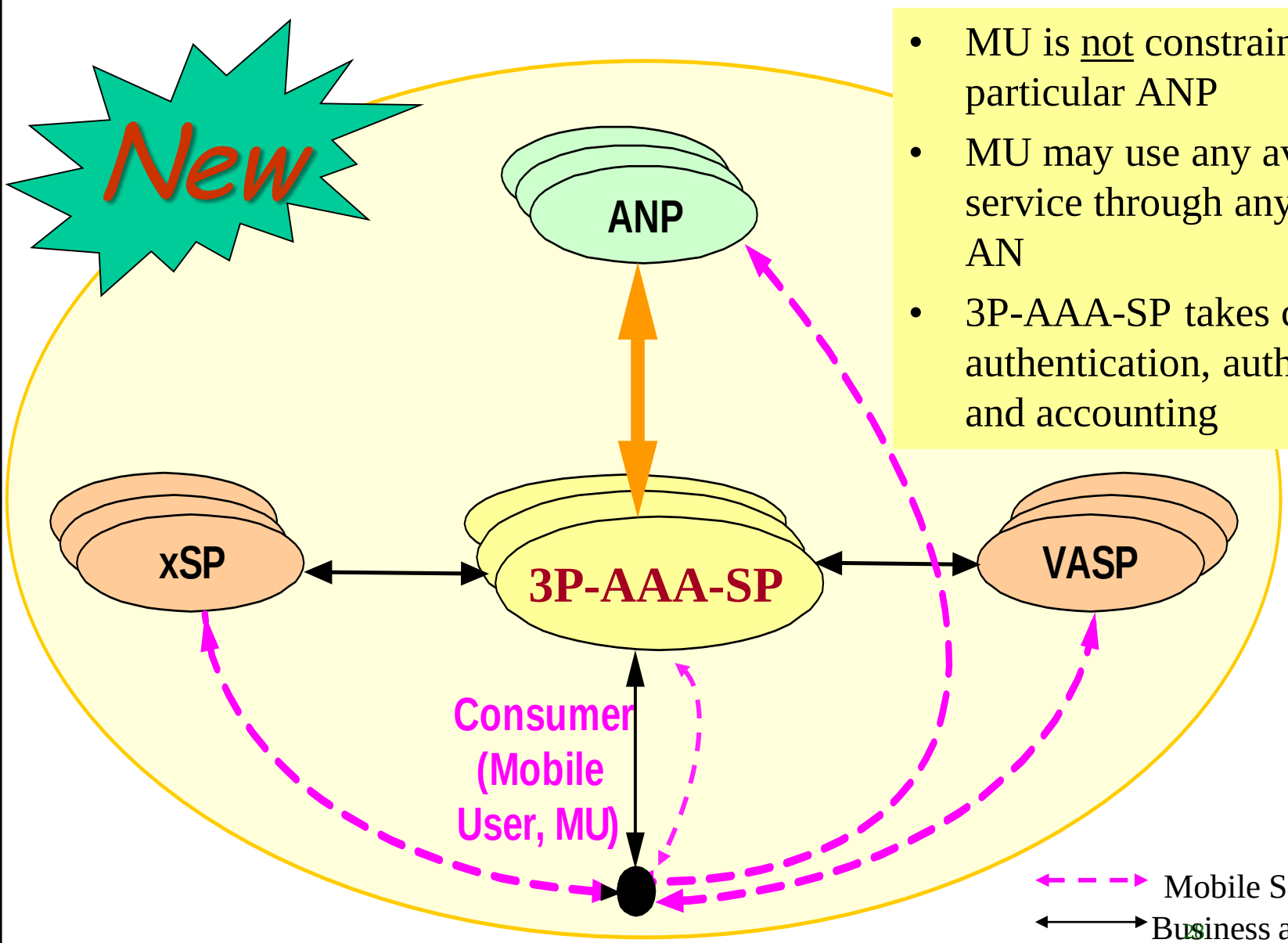
Possible transition solution

- Enabling users to avail of AAA services through a 3P-AAA-SP concurrently with present (SBM) procedures.
  - ANP & xSP service payment through this 3rd party SP
  - Leads to CBM
- Prepaid, and multiple U/SIM cards
  - Problem with multiple MT numbers

Trend from SBM to CBM

- Future mobile phones/terminals MTs
  - Bought in a shop without any binding to a particular network provider
  - Address/number bought separately and assigned (inserted) by the user
    - E.g. IPv6 address
    - This address is not bound to a particular network
    - KEY: the address is owned by the user!
      - E.g. s/he may move it from one device to another

CBM techno-business model



- MU is not constrained to any particular ANP
- MU may use any available service through any available AN
- 3P-AAA-SP takes care of authentication, authorization and accounting

CBM: Main Characteristic

- MU is a **consumer,** not a subscriber.

Achieved by:

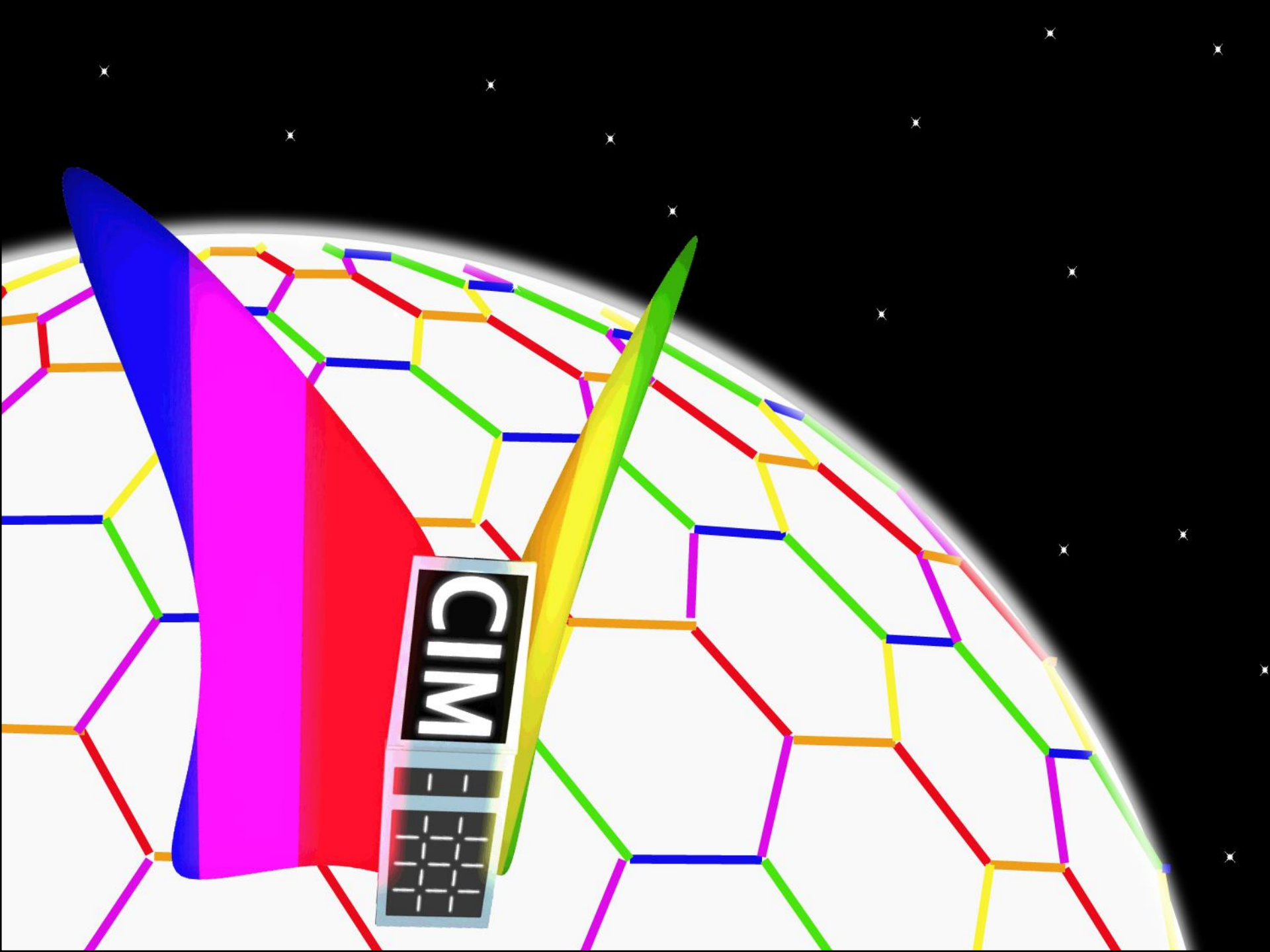
1. 3P-AAA-centric service provision
   - Realized by giving
     - Key role to a '3P-AAA business entity'
       - 3P-AAA Service Providers, who is
       - NOT traditionally a stakeholder in the wireless communications business
   - **Nearest analogy:** credit card companies
     - They are possible & likely candidates !
2. MU 'owns' own (MT's) IPv6 address(es)

CBM: Other Attributes / Promise

- Network-independent business model foundation
- Potential to open the wireless communications market:
  - Ease of xSP entry
  - Niche and specialized AN service provision
    - New, as yet unforeseen
    - To be provided by new ANPs & others
    - Benefiting MU's specialized needs (collective, individual)
  - Wider range of freedom & autonomy for
    - ANPs (especially new ones)
      - Levelling the AN playing pitch & fostering real AN competition
    - MUs
      - All to their benefit in terms of greater range ABC&S offerings, etc.
- Important business driver for the evolution of ABC&S networking

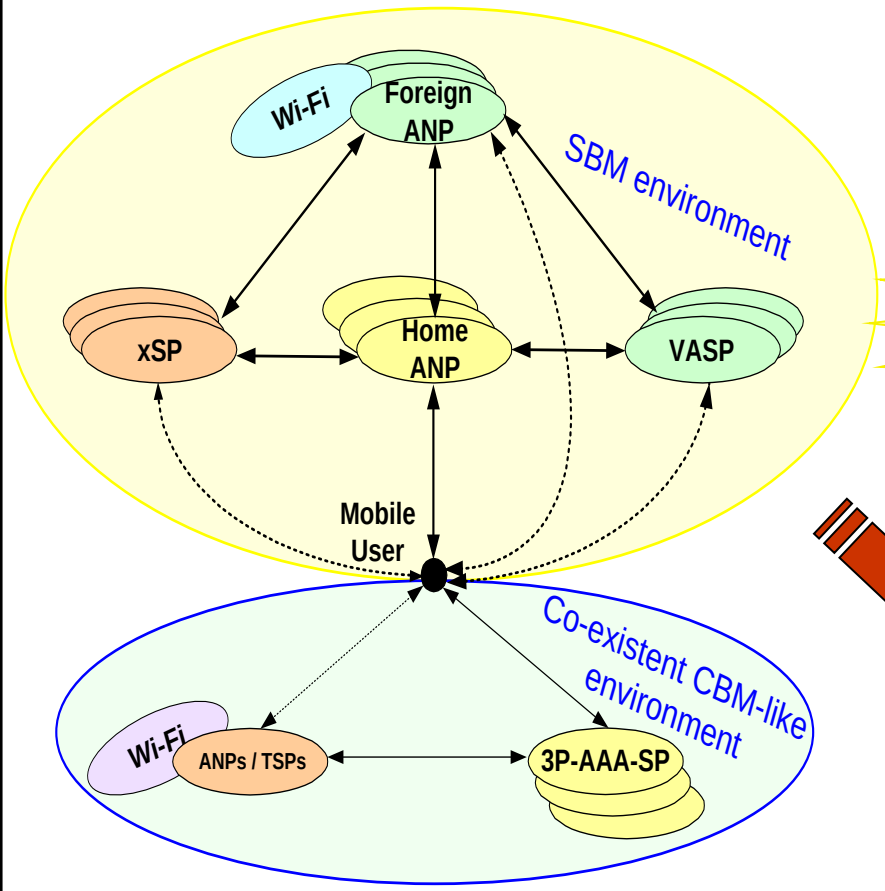
CBM: PROs

- All xSP able to offer their services through ANP networks
  - Without having direct business agreement with the ANPs
  - xSPs have such agreements only with 3P-AAA (mediator between xSPs and ANPs).
- ANPs and xSPs charges
  - To be paid indirectly through 3P-AAA-SPs
  - Security: user identified by a tamper-resistant smart CIM card, e.g. containing her/his credit card details or 'secure AAA ticket'
- Other PROs: (besides opening ANP and xSP markets, etc.)
  - Fast deployment and flexible provision of new services
  - Prevents scalability problems
  - NO real differentiation between HANP and FANP
    - E.g. roaming much reduced, if not in many ways eliminated! (a local call will always be a local call regardless of where MUs have roamed to)


CIM

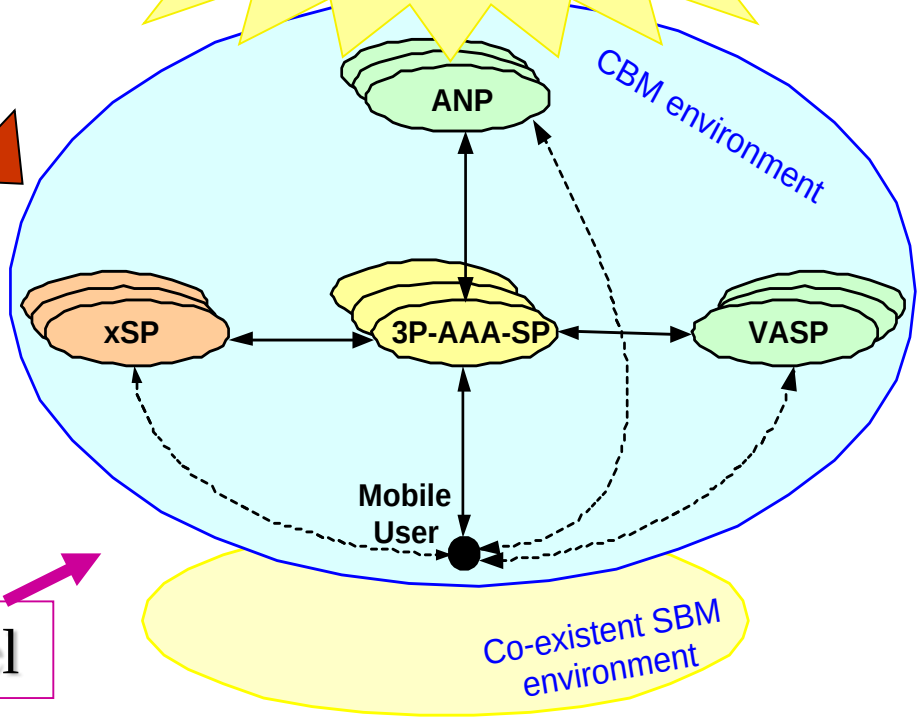
From SBM to CBM

SBM – present model



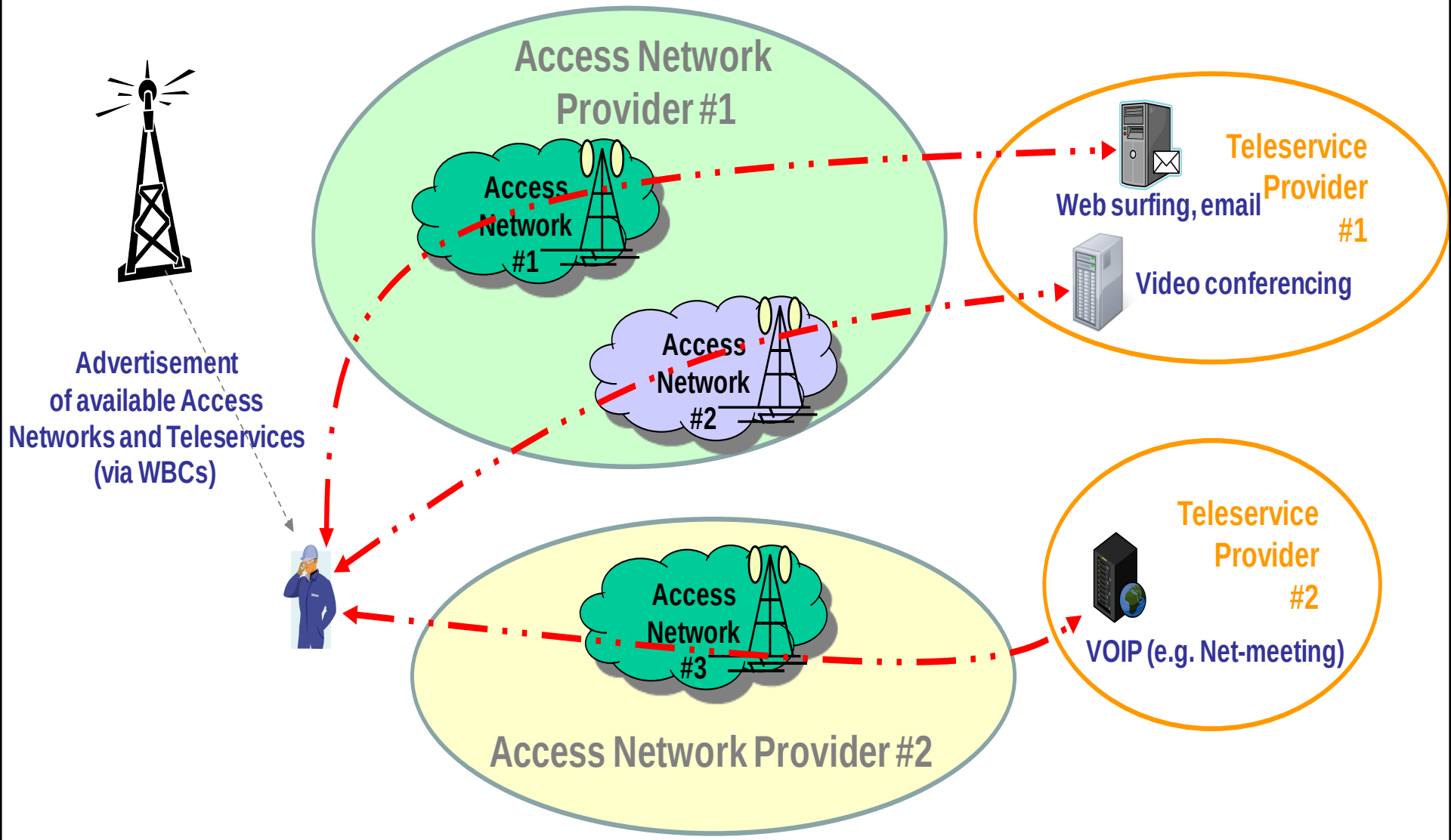
The resulting wireless environment

Ubiquitous Consumer Wireless World (**UCWW**)

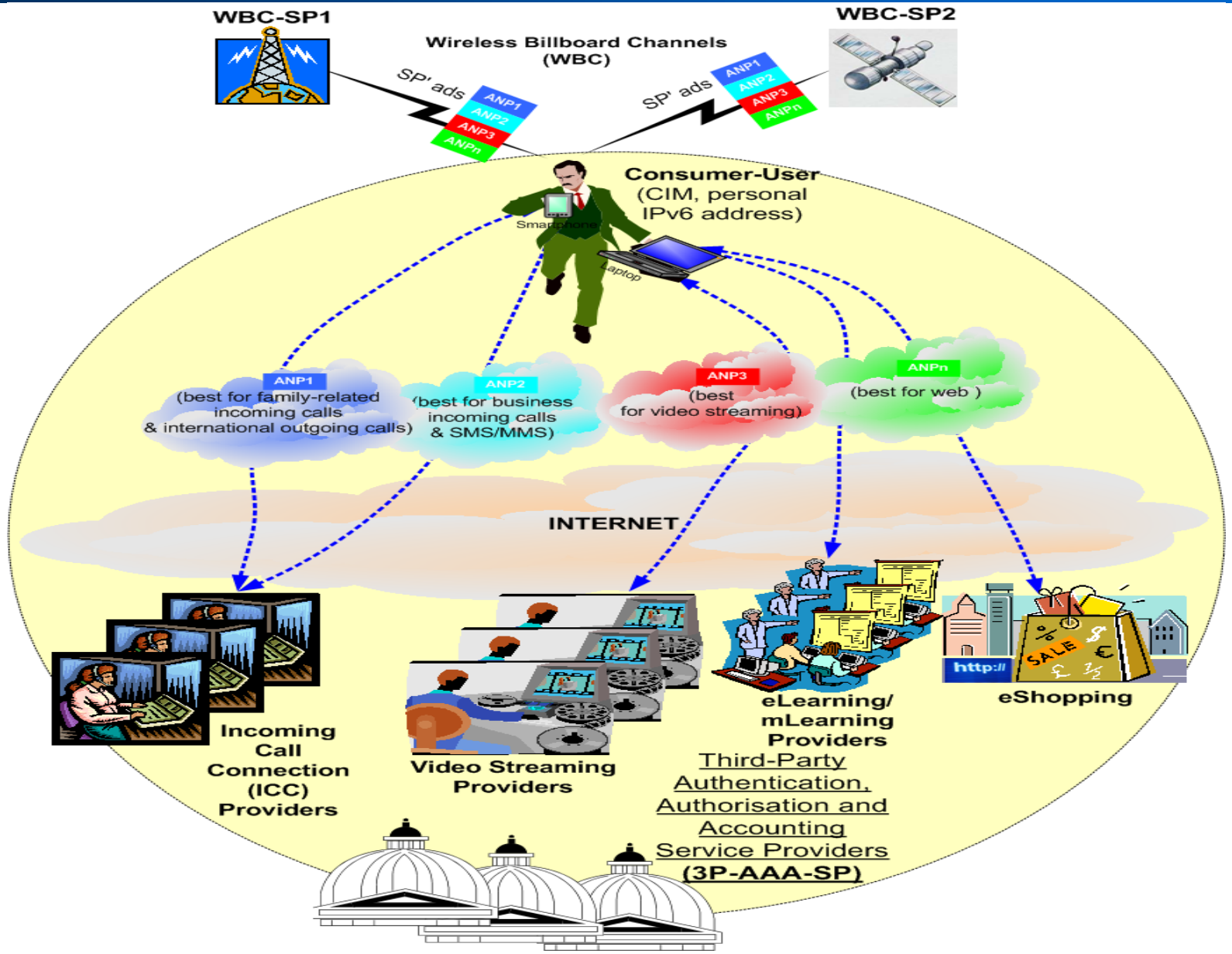


CBM – future model

CBM Wireless Environment: UCWW

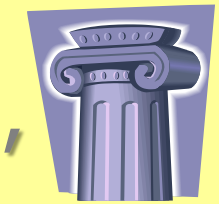


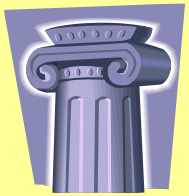
UCWW: ABC&S paradigm



CBM: Technological Foundations

- 3rd-Party Authentication, Authorization and Accounting, **3P-AAA**
- New **personal** IPv6 **address** & **CIM card**





The two Pillars

- Wireless Billboard Channels, **WBCs**

Business Pillar

- Consumer-oriented Incoming Call Connection service, **ICC**

Re-invented

CBM: Techno-Requirements

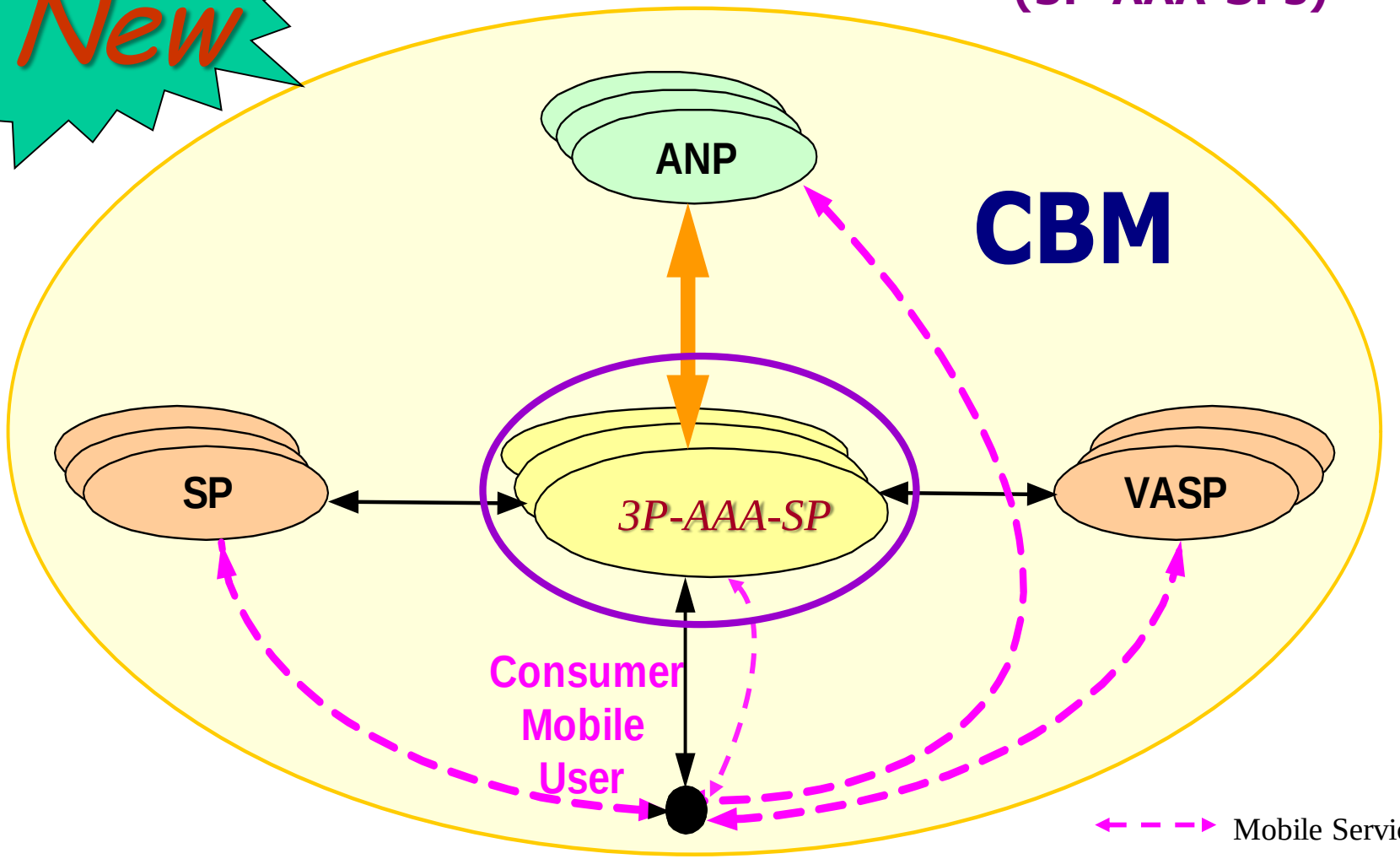
New architectural entities, technical and standardization innovations required for a managed CBM revolution

- **3**rd **P**arty **A**uthentication, **A**uthorization and **A**ccounting service providers (**3P-AAA-SPs**)
- **A**dvertisement, **D**iscovery and **A**ssociation (**ADA**)
  - *of Access Networks (AN)*
  - *of Mobile Services*
  - *Global standard*
- **W**ireless **B**illboard **C**hannels (**WBCs**)
  - *Global, regional, national, local …WBCs*
  - *Global standardization*
  - *WBC-SPs licenses for provision of WBC service*
  - *WBCs supported by ADA portals*
- Consumer-oriented **I**ncoming **C**all **C**onnection (**ICC**) service

CBM: 3P-AAA

New

- **Third-Party Authentication, Authorization and Accounting Service Providers (3P-AAA-SPs)**



3P-AAA: Service and Service Providers

- **3P-AAA-SPs are new business entities**
- Central role
- **Goal**
  - **Separation of** the administration and management of users' AAA activity **from** the supply of a wireless access network service
- Status
  - Network-independent, autonomous, and trusted business entities

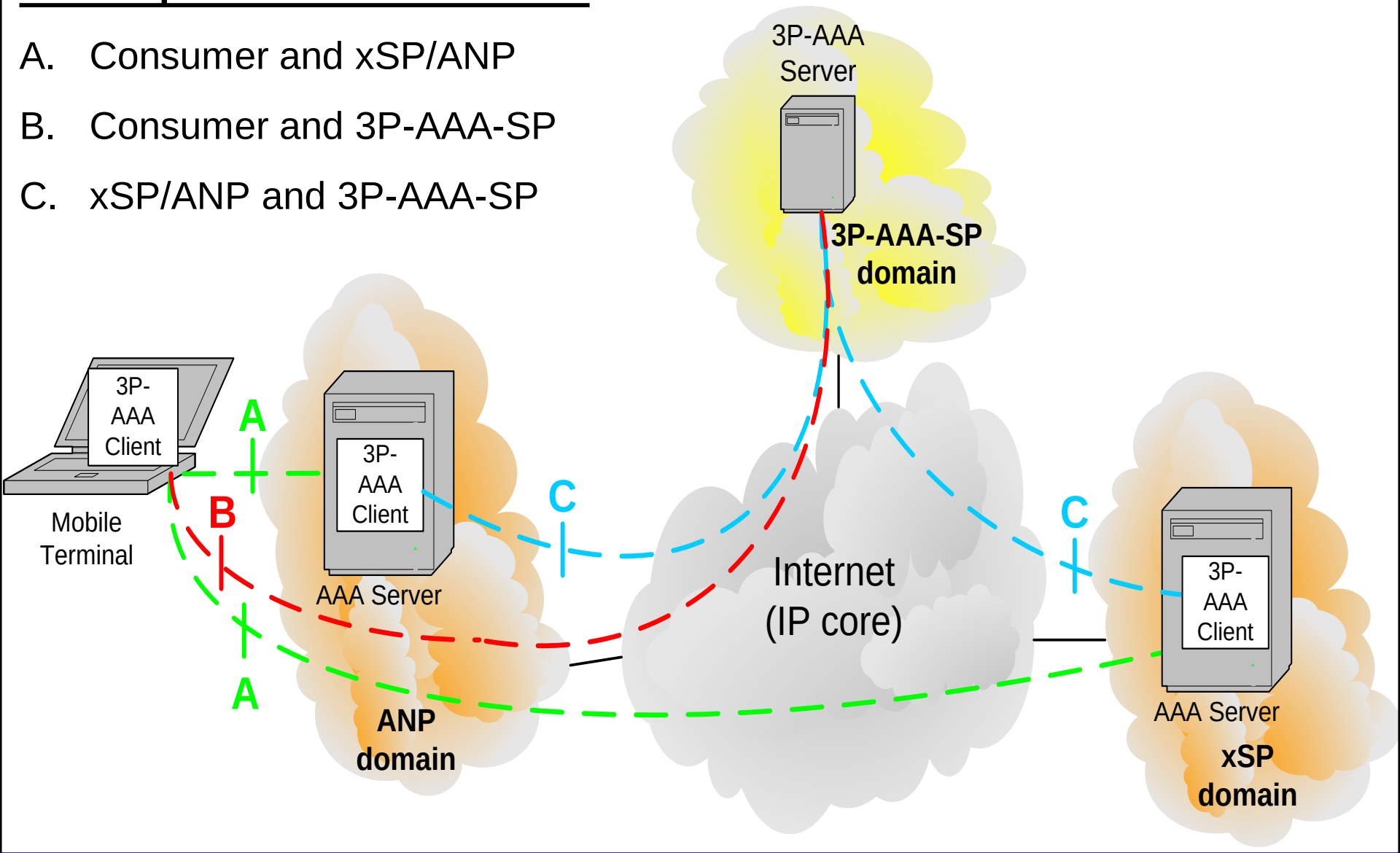
3P-AAA: Functional Model

3 Principle Interfaces between:

A. Consumer and xSP/ANP

B. Consumer and 3P-AAA-SP

C. xSP/ANP and 3P-AAA-SP

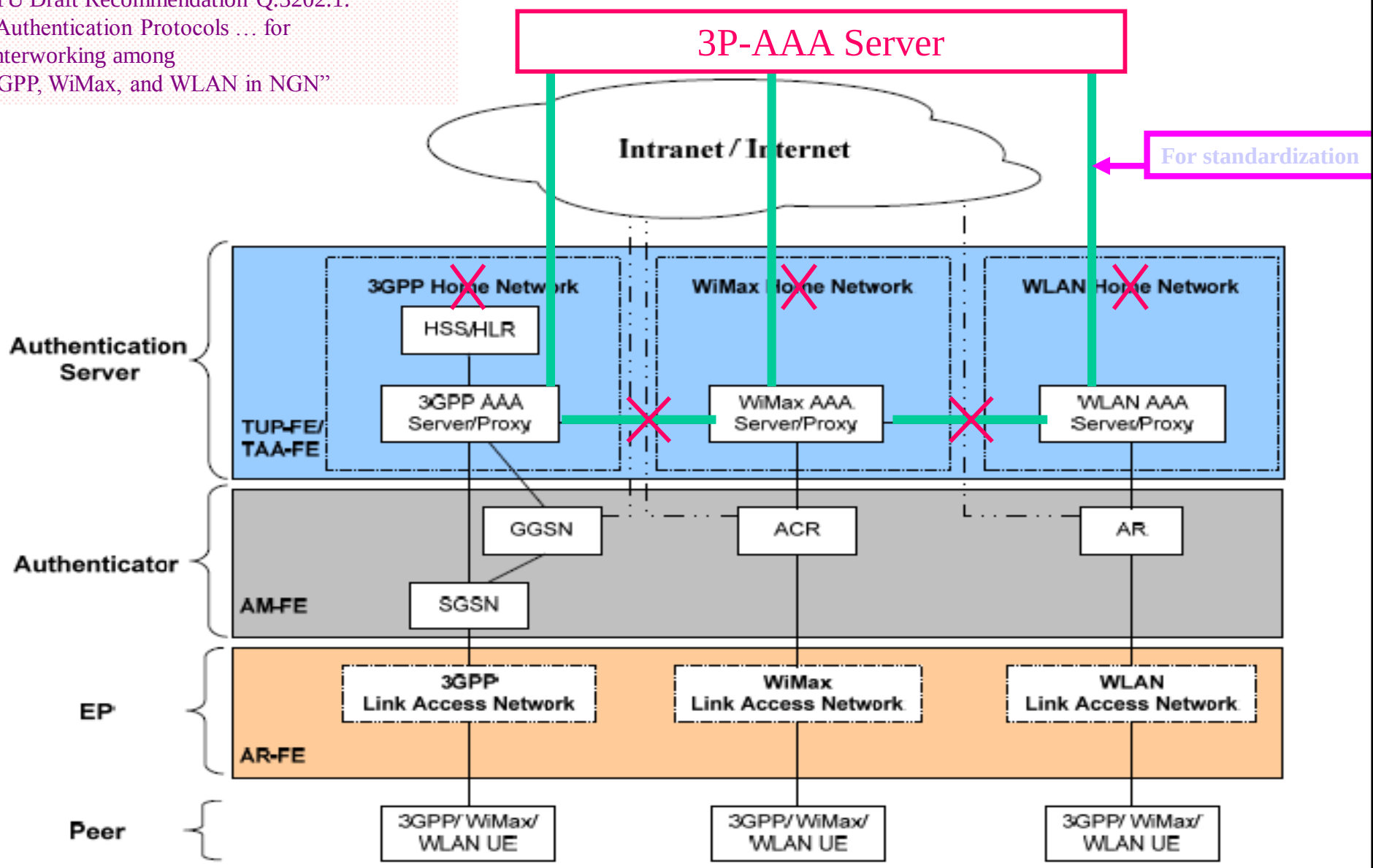


3P-AAA: Standardization

- Standardization:
  - Interface architecture
  - Signalling protocol
- **Business Development Opportunities:**
  - New business entities: 3P-AAA service providers
    - Handling all wireless communication purchasing transactions
  - Expansion into all areas of purchasing through universal CIM cards
  - Wireless payment applications (“mobile money” / “wireless wallet”)
- **Social Impact:**
  - Users not tied to any ANP – full mobility potential
  - Market fairness and openness
    - Access network market +++
  - Zero roaming charges

NGN authentication architecture for interworking among wireless access networks & proposed modifications for CBM

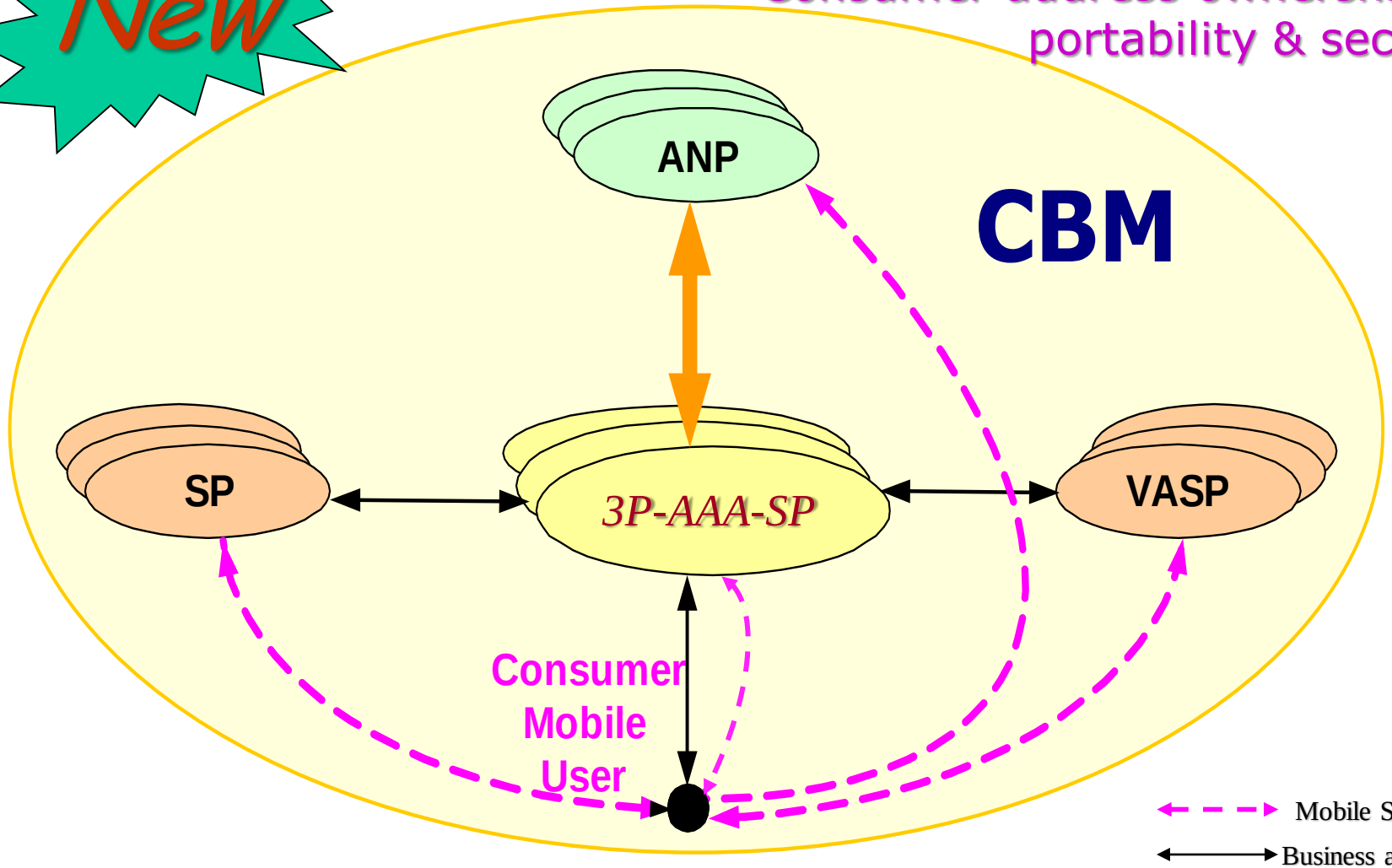
ITU Draft Recommendation Q.3202.1:
"Authentication Protocols … for Interworking among
3GPP, WiMax, and WLAN in NGN"



CBM: Address Ownership

New

- Third-Party Authentication, Authorization and Accounting Service Providers (3P-AAA-SPs)
- Consumer address ownership, portability & security



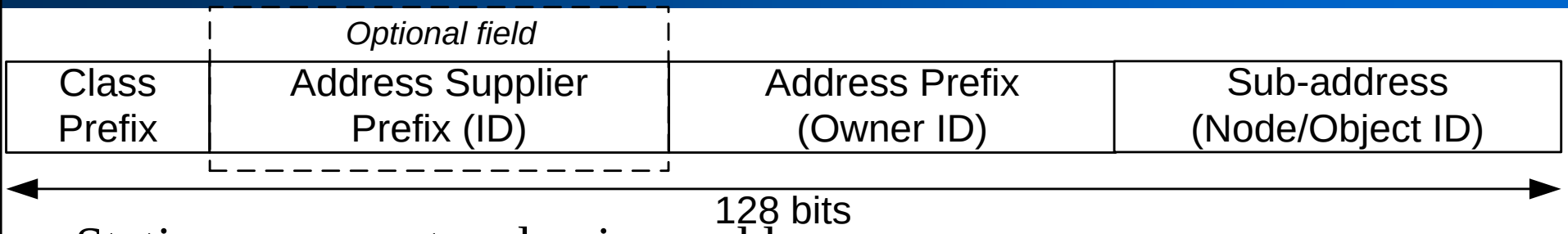
New ‘Personal’ Address scheme

- New globally-significant network-independent ‘Personal’ Address
  - Consumer address ownership and
  - Full address portability is enabled
  - IPv6 addresses
    - Separate class of network-independent “personal” IPv6 addresses
    - >n.10 billion addresses in this class

- **Security**
  - Universal **Consumer Identity Module (CIM) card**
  - ITU-T **X.509 digital certificate** security
  - **CIM replaces SIM** in UCWW

- **Standardization - required for these**

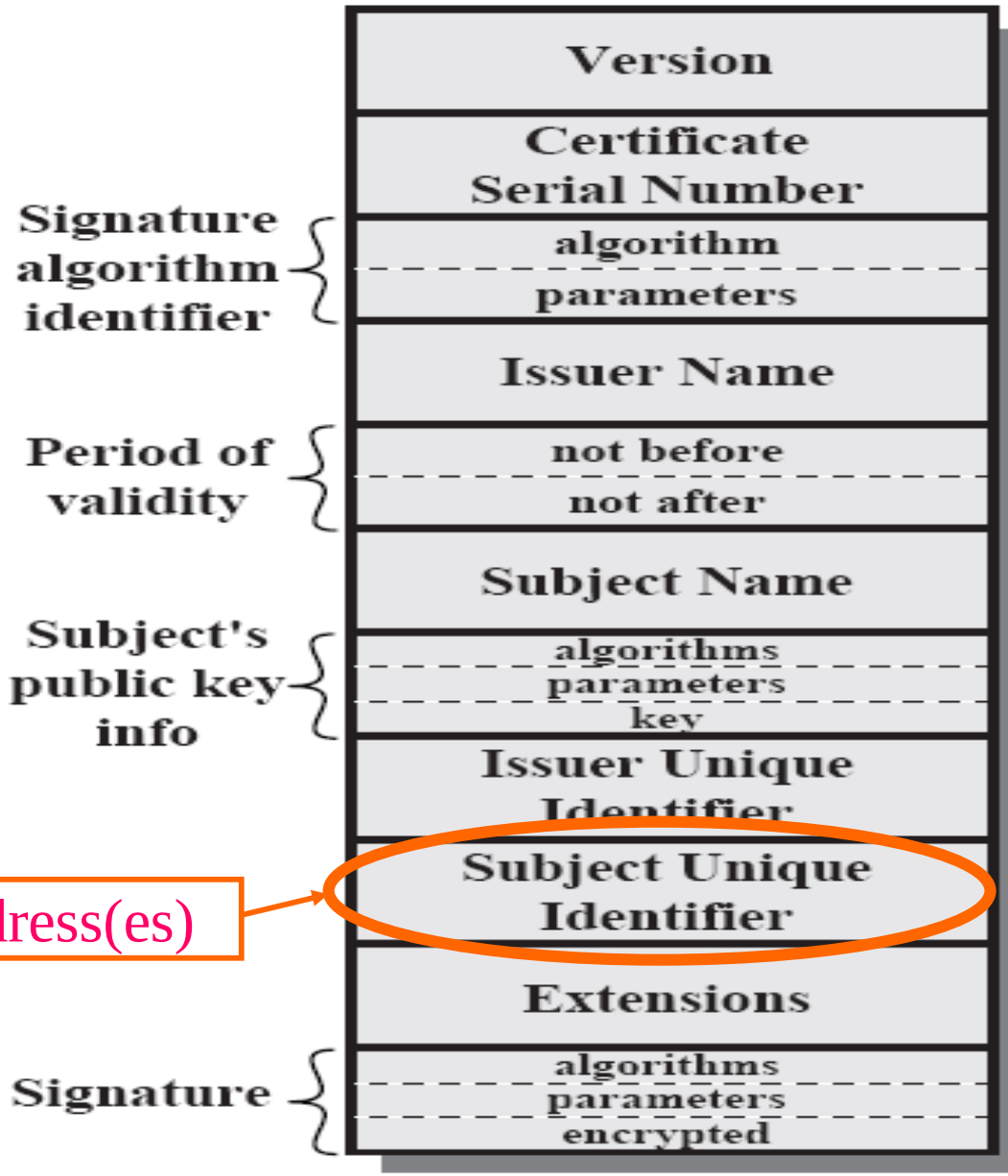
New ‘Personal’ IPv6 Address (PIPv6)



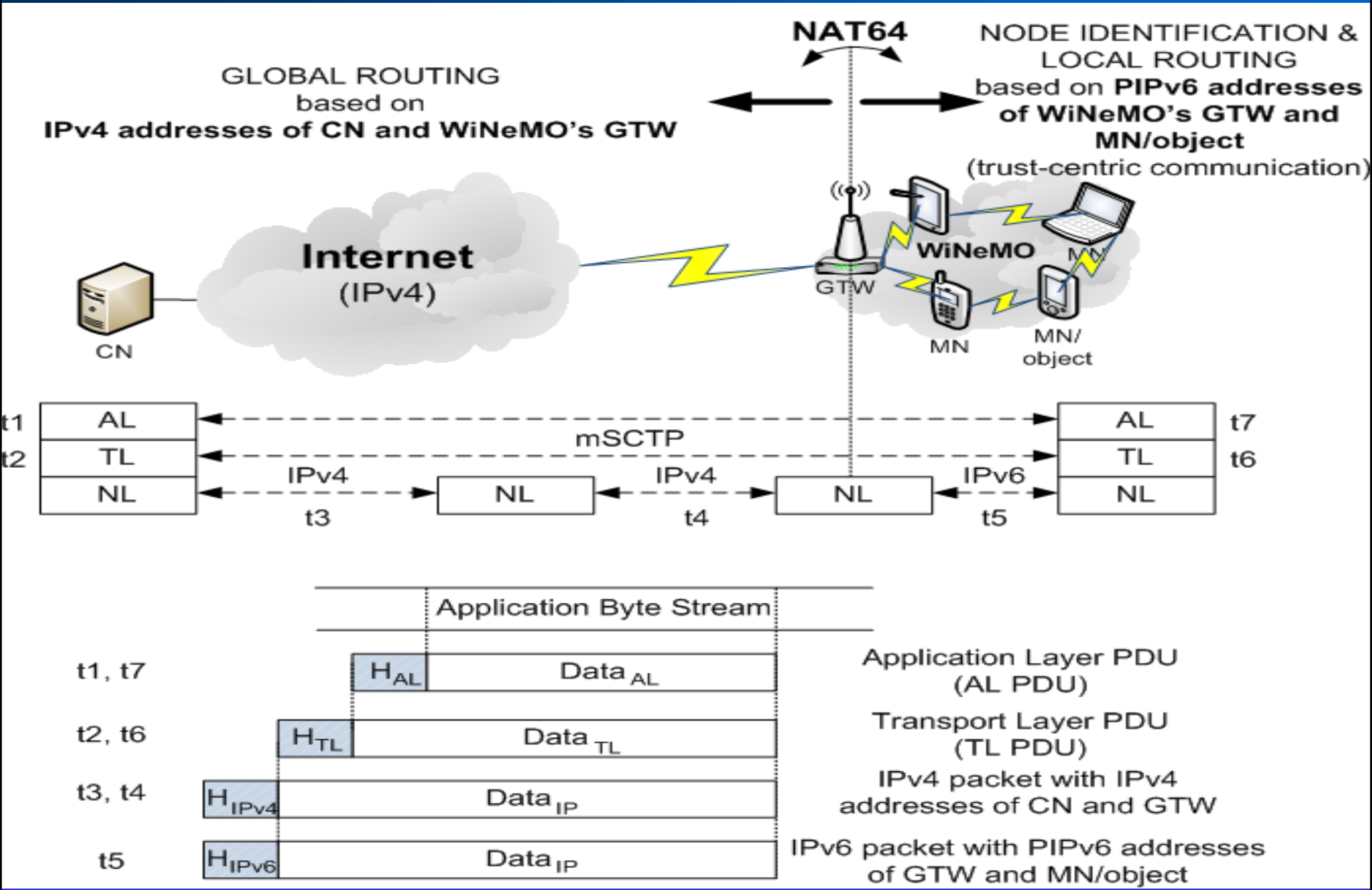
- Static, permanent and unique address
- Network-independent
- Managed and allocated by a global address supplier
- Its uniqueness will eliminate the need for duplicated address detection, which is compulsory in IPv6 networks with stateless address autoconfiguration (SLAAC)
- Can give more flexibility to set up and operate wireless networks of moving objects (WiNeMO) because a node (object) can use the same address (identity) in every case and in any communication scenario
- Could be used as a long-term identity solution that can prevent impersonation, Sybil and other types of attacks, can help distinguish whitewashers from newcomers in WiNeMO, and be useful in schemes to deter security attacks

PIPv6 & ITU-T X.509

- **PIPv6 address:**
  - Purchased by user
  - Embedded into his/her ITU-T X.509 digital certificate
    - In field '*Subject Unique Identifier* '



PIPv6: Generic Communication Scenario



New CIM card

- Universal X.509-based Consumer Identity Module (CIM) card
- Through it, an owner would use his/her PIPv6 address with whatever mobile device s/he chooses and through which the usage of services may be paid.
  - Through the relevant CAs' public key infrastructures (PKIs), the validity of the certificates of all parties to a transaction may be mutually checked as required.
- Can be developed by means of the Java Card technology
  - Provides highly secure, market-proven, and widely deployed open-platform architecture for the rapid development and deployment of smart card applications meeting the real-world requirements of secure system operations.
- The Java Card may typically be a plastic card containing an embedded chip

INTELLIGENT RECOMMENDATION OF MOBILE SERVICES TO CONSUMERS

WBCs and ADA

Wireless Billboard Channels (WBC)

and

Services' **a**dvertisement,

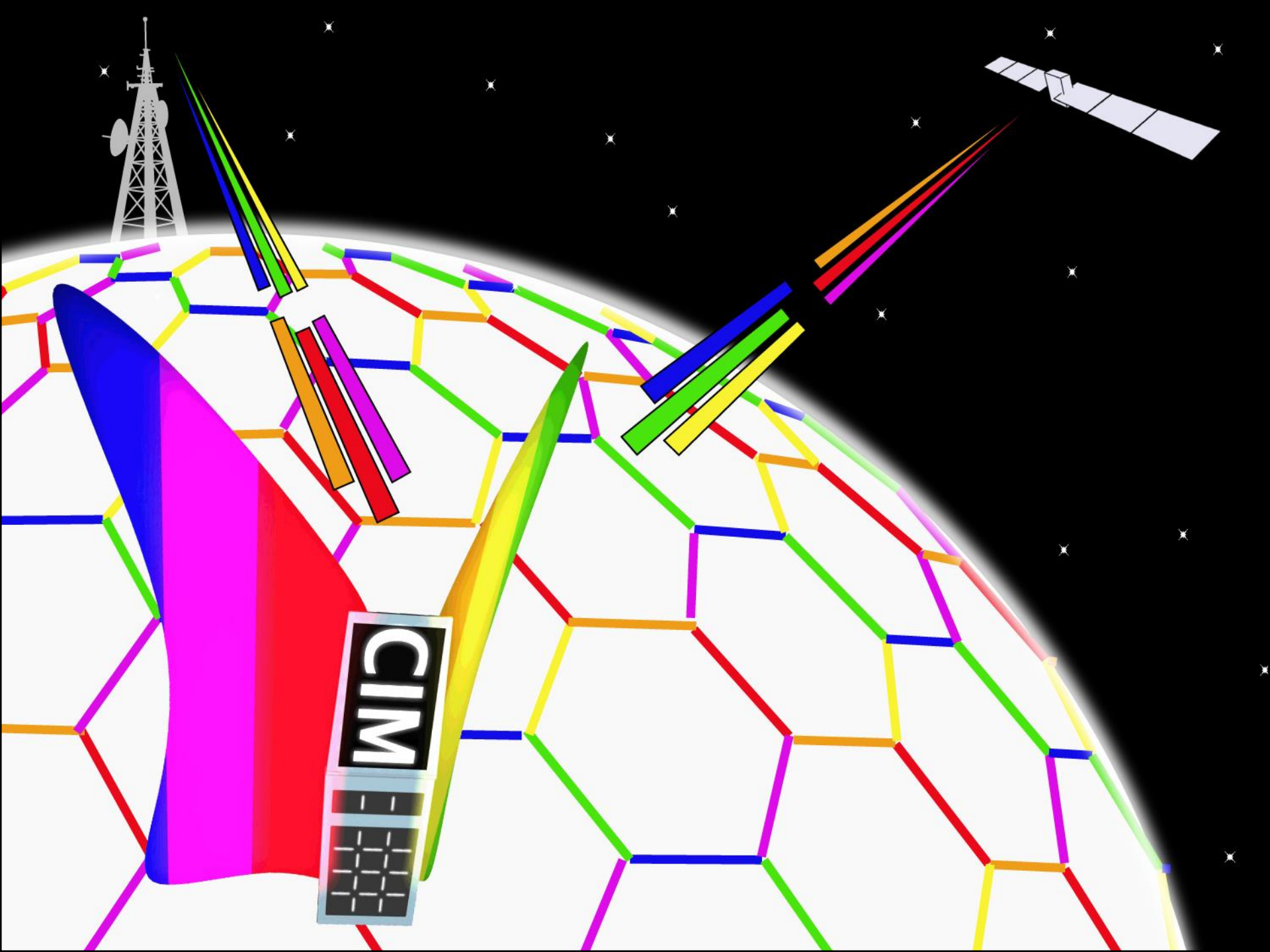
discovery *and*

association (*ADA*)

WBCs and ADA: Need

1. If the Mobile User (MU) is a consumer located in the footprints of several wireless access networks, how does he/she 'see' or discover these networks well enough to make ABC&S decisions in respect of the various services MU may wish to access?

2. How do access network providers let the consumer know of their existence and services?
   - Since CBM access network providers have no subscribers but wants users to use their AN


CIM

Wireless Billboard Channels (WBC)

- Wireless equivalent of roadside advertisement billboards

- ‘Push’ advertisements means for Access Network Providers
  - Access networks presence & current service offerings
  - Association procedures for a consumer to obtain services

- Consumer’s MT
  - Receives service offerings on WBC
    - Discovers, updates, matches service offerings against ABC&S criteria under different profiles …
    - Makes ABC&S network-service match decisions

- Advertisement, Discovery and Association (**ADA**) functions and activities
  - Particular to consumer wireless communications environment

WBCs and ADA (cont.)

- In seeking to achieve ABC&S for the MU/MT in a normal environment of multiple heterogenous ANs, in order for MTs to able to discover the ANs and their attributes there is a **need for the automation of the entire process** of
  - **A**dvertisement,
  - **D**iscovery,
    - Re-configuring MT process if necessary
  - **A**ssociation execution,
  - Specific requirements in the configuration and use of
    - ANs by a newly associated MT and
    - Application services
      - I.e. reconfiguration and adaptability actions
  - Transparency
    - To the user, as much as the user desires (MU/MT profile issue)

WBCs and ADA (cont.)

- MTs able to discover the ANs and their attributes through WBCs
  - The direct approach, and well-known consumer business practice

  and/or

  - Through AN-services-offerings database portals,
    - Probably also operated by the WBC-SPs
    - Such DBs may also contained more detailed information on any AN service offerings, association rules, procedures etc. or re-direction to ANP-operated AN-service-offerings & association portals.
    - **Push mode** seems attractive in recent years!

WBCs: Typical MT Operation

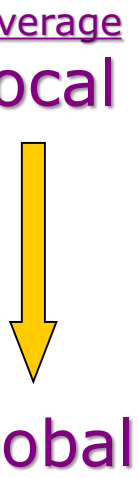
- MT dynamically compiling information on ANs in the locations from which MT would normally be doing its communications (whether already in the footprint or planning to be, …)
- MT matching ANs service offerings' profiles to user/terminal profiles-roles and
- Proposing ABC&S solutions to the user through (optional) MT reconfigurability and application service adaptability functionalities.
- The user then, according to one of their roles, e.g. family parent, will select 'best' ANs for particular service, using criteria such as price/performance & context
  - E.g. the ANs to be used for VoIP based on time/location/callee info

WBCs: Service Advertisements

- Primarily of ANs:
  - Pro-active “push” advertisement nature – attractive!
  - Analogy: billboard advertising
- ANPs will focus advertisements towards their markets
  - Thus: global, regional, national, local WBCs will be required.
- Also advertisement of other mobile services (xSPs) could be envisaged
- Result/Benefit:
  - Equality among ANPs, e.g. existing ANPs vs. new entrants looking for consumers.

WBCs: Salient Characteristics

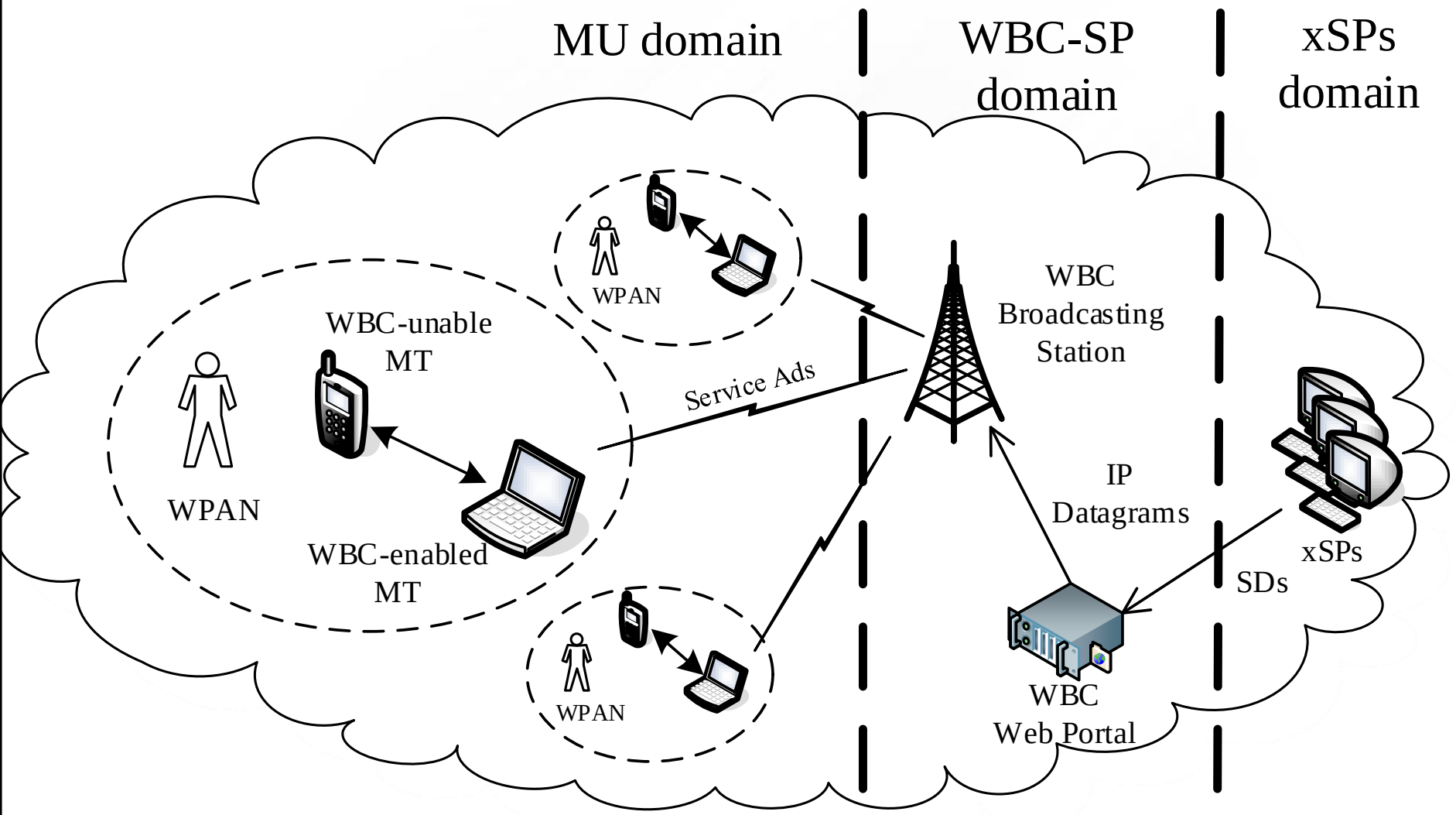
- Simplex Broadcast Narrowband channels
- **Geographic coverage regimes**
  - ***Local, Regional, National & Global***
- Broadcast Platforms (there may be many)
  - Digital Audio Broadcasting (DAB)
  - Digital Radio Mondiale (DRM)
  - Digital Video Broadcast Handheld (DVB-H)
  - Satellite Digital Multimedia Broadcasting (S-DMB)
  - Digital Audio Radio Satellite technology
- Operators: non-ANP service providers
  - Existing radio & TV broadcasters ?



WBCs: Summary

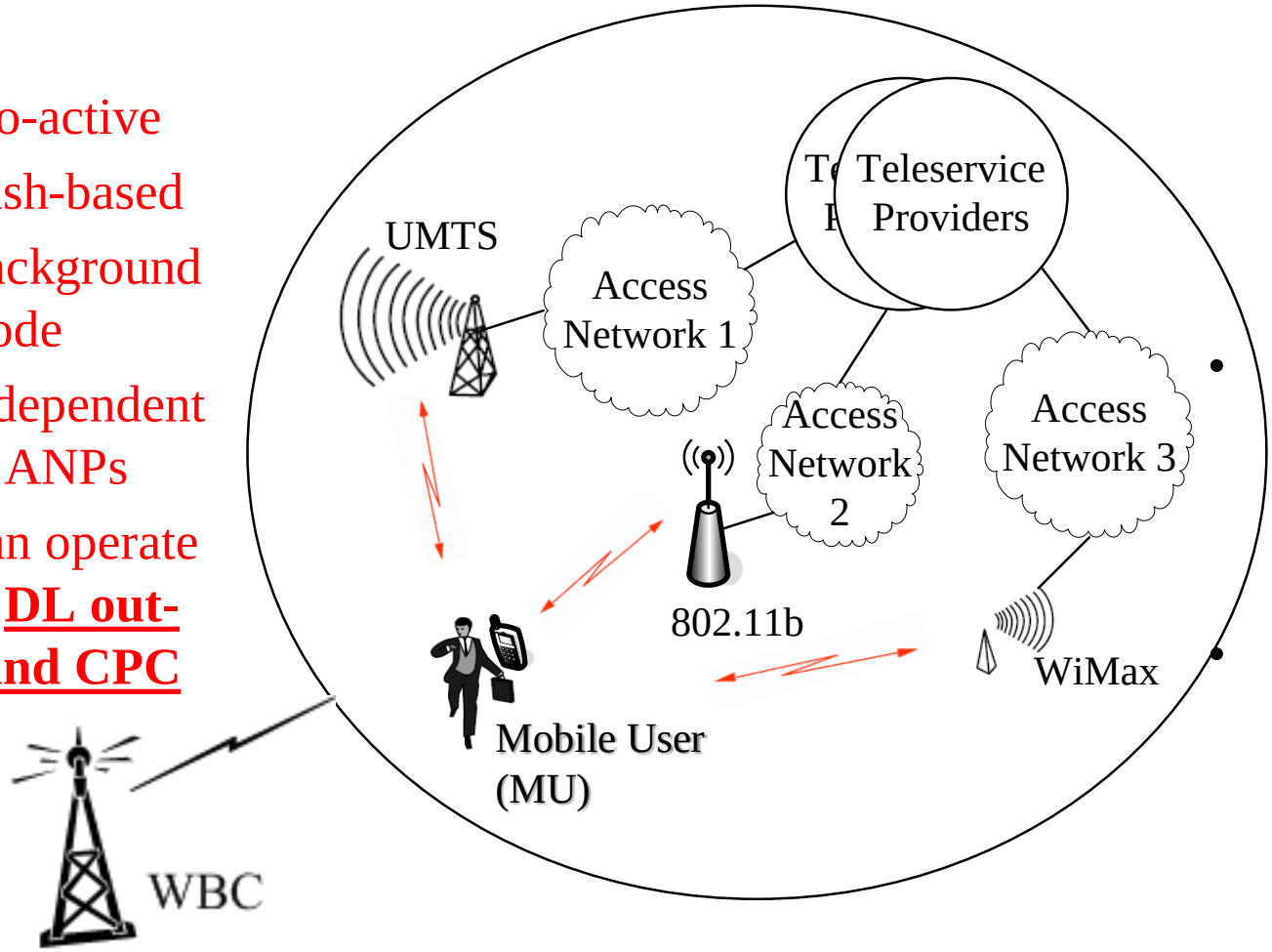
- Standardization
  - Spectrum allocations
  - Protocol architecture
    - Physical, data-link, and service-layer protocols, advertisement streaming structure, including data scheduling, indexing and encoding, and service discovery and description models.
- **Business Development Opportunities**
  - **New service provider entities** (WBC-SPs)
    - Existing broadcast service providers
    - Advertisers: of ANPs, xSPs, and others
- **Social Impact**
  - **Consumer awareness** of all current service offerings
  - '**Freedom of choice**' strongly supported for consumer
    - Choice of 'best' service from what's available
    - Personal profile matching & user-driven ABC&S decisions
  - **Competition Stimulus**: new services, service costs, etc.
  - **Fair and equal** pro-active **access to consumers** for
    - Existing and NEW access network providers
    - Others - xSPs, mobile handset manufacturers, etc.

WBC: Domains


MU domain
WBC-SP domain
xSPs domain
WPAN
WBC-unable MT
WPAN
WBC-enabled MT
Service Ads
WBC Broadcasting Station
IP Datagrams
xSPs
SDs
WPAN
WBC Web Portal

WBC: Concept

- Pro-active
- Push-based
- Background mode
- Independent of ANPs
- Can operate as **DL out-band CPC**



WBC Beneficiaries:

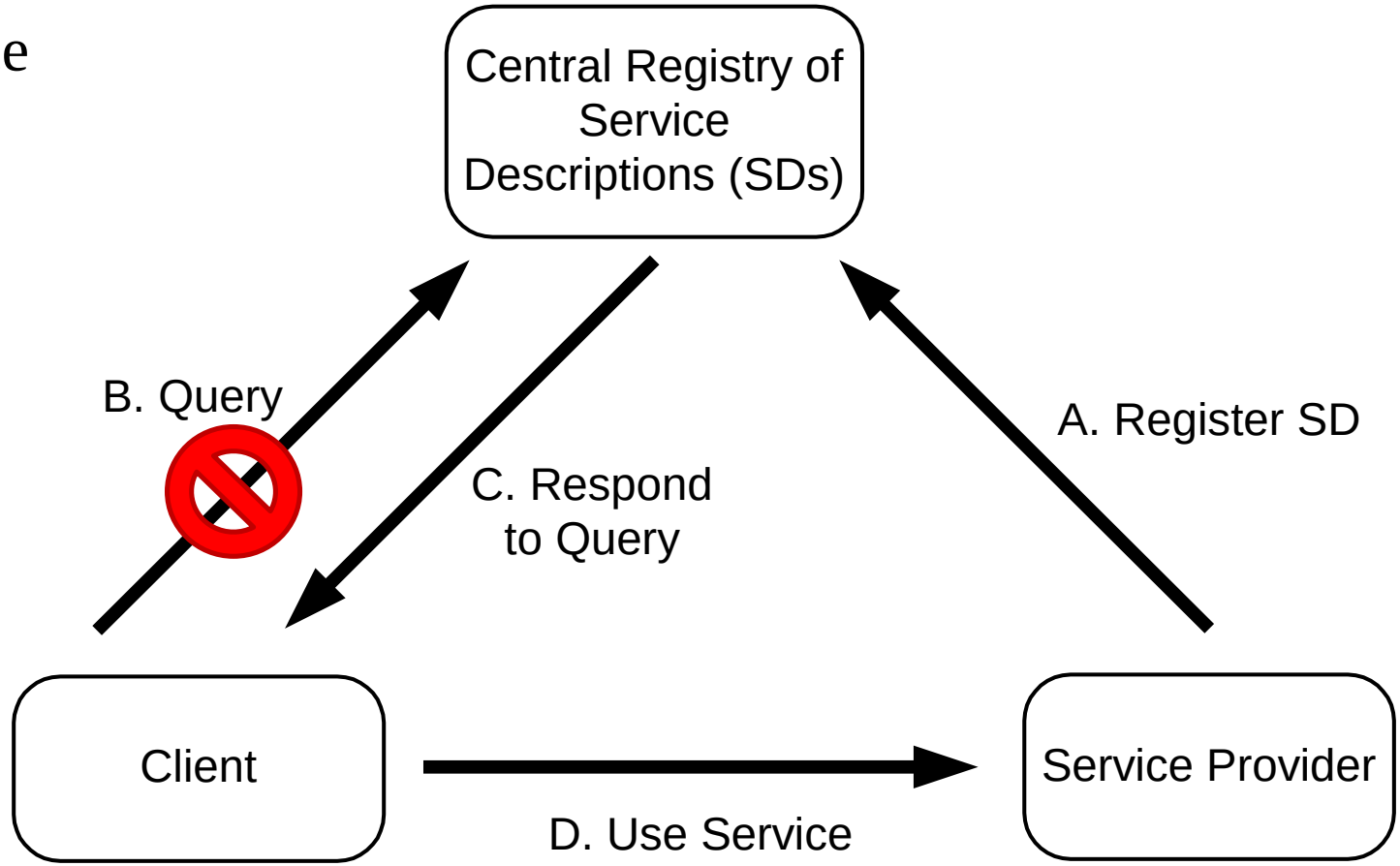
- Access Network Providers (ANPs)
  - Advertise their presence and services and attract MU's custom
- Mobile Service Providers (xSPs)
  - Advertise & update profiles of their services
- Mobile Users (MUs)
  - Discover available ANPs/xSPs, their services, their tariffs and QoS regimes, and use these for ABC&S

WBC: ADA

- Purpose of WBC is to facilitate the discovery of services (ANCS & MS)
- Numerous service discovery protocols already in existence
- WBC service discovery model based loosely around the model used in these protocols

Basic Service Discovery Model

- Used by service discovery protocols, e.g. Jini, SLP, Salutation.
- Based around registry of service descriptions (SDs)

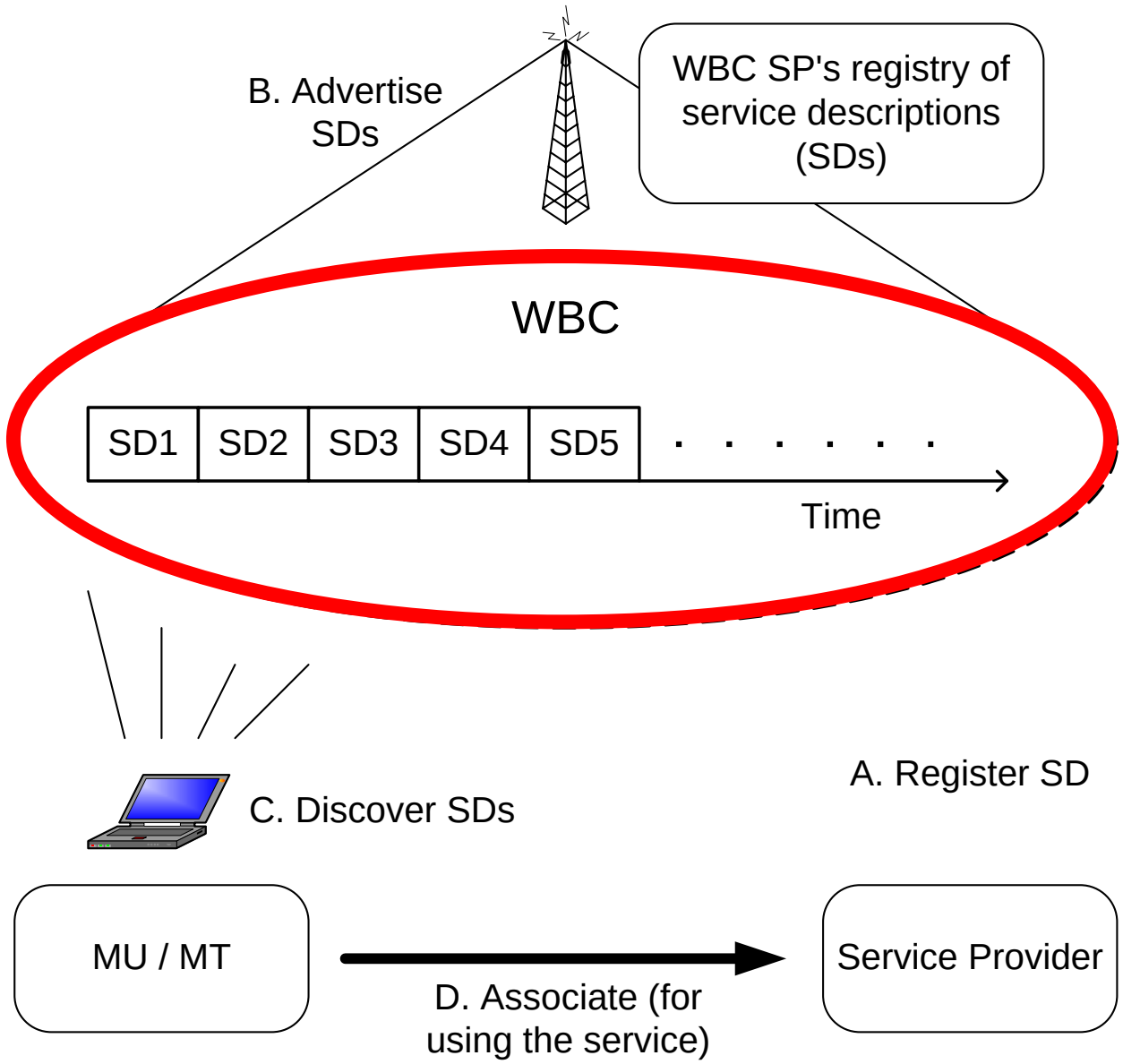


Basic Model as Applied to WBC

- WBC is a simplex “push” channel
  - Does not facilitate queries to registry
- Solution is to broadcast all SDs in turn
  - MU waits for required SD to be broadcast
- Registration of services with WBC-SP, separate to WBC.
- WBC-SP may also offer “query-response” service over Internet, separate to WBC.

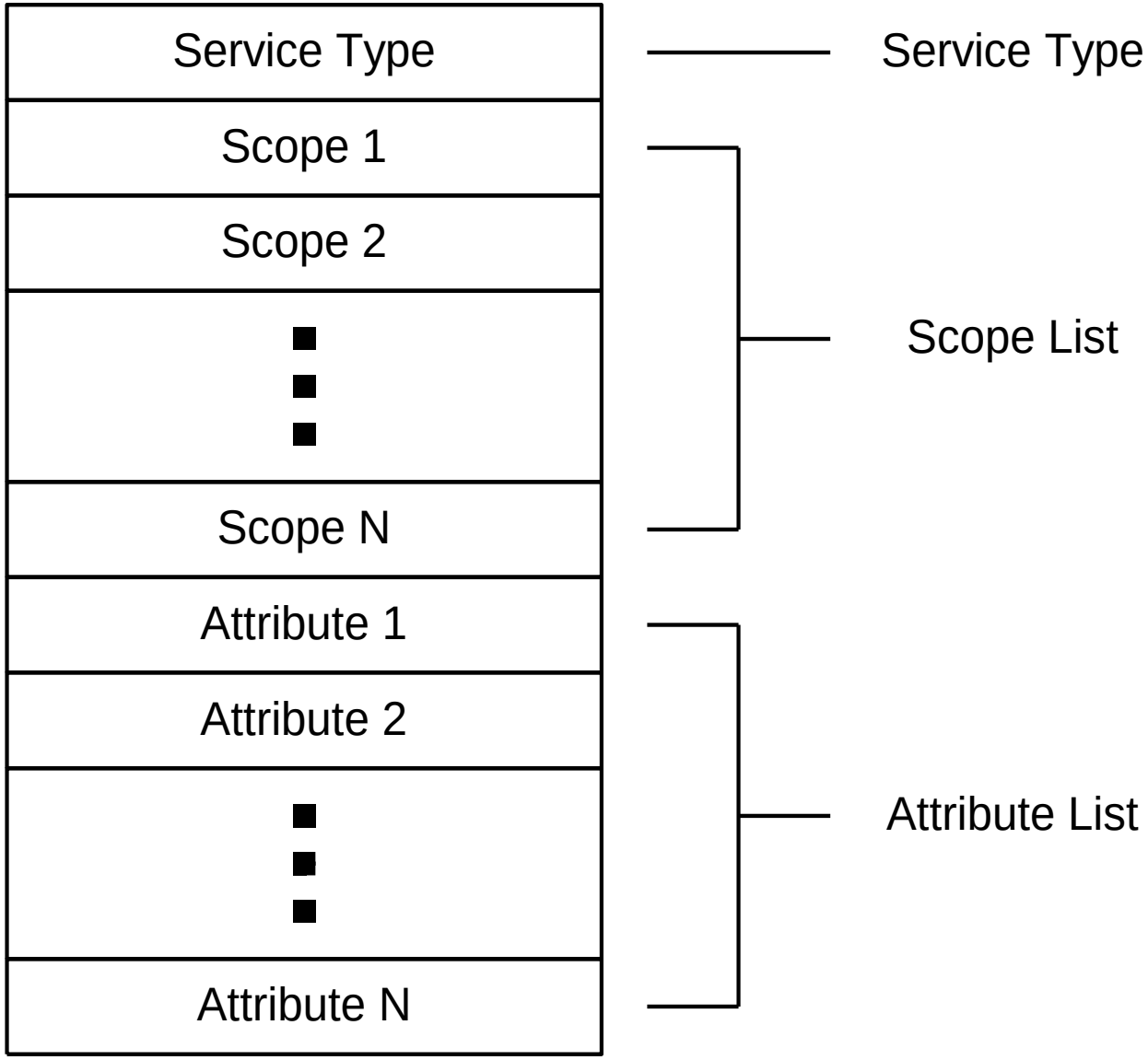
WBC: ADA Model

- Basic service discovery model, adapted to “push” nature of WBC
- Still based around registry of SDs, but NO query-response
- Instead all SDs are broadcast on WBC



WBC: SD Format

- Based on SD format of most popular service discovery protocols
  - Jini, SLP, and Salutation.
- Consists of 3 parts:
  - Service type
  - Scope list
  - Attribute list



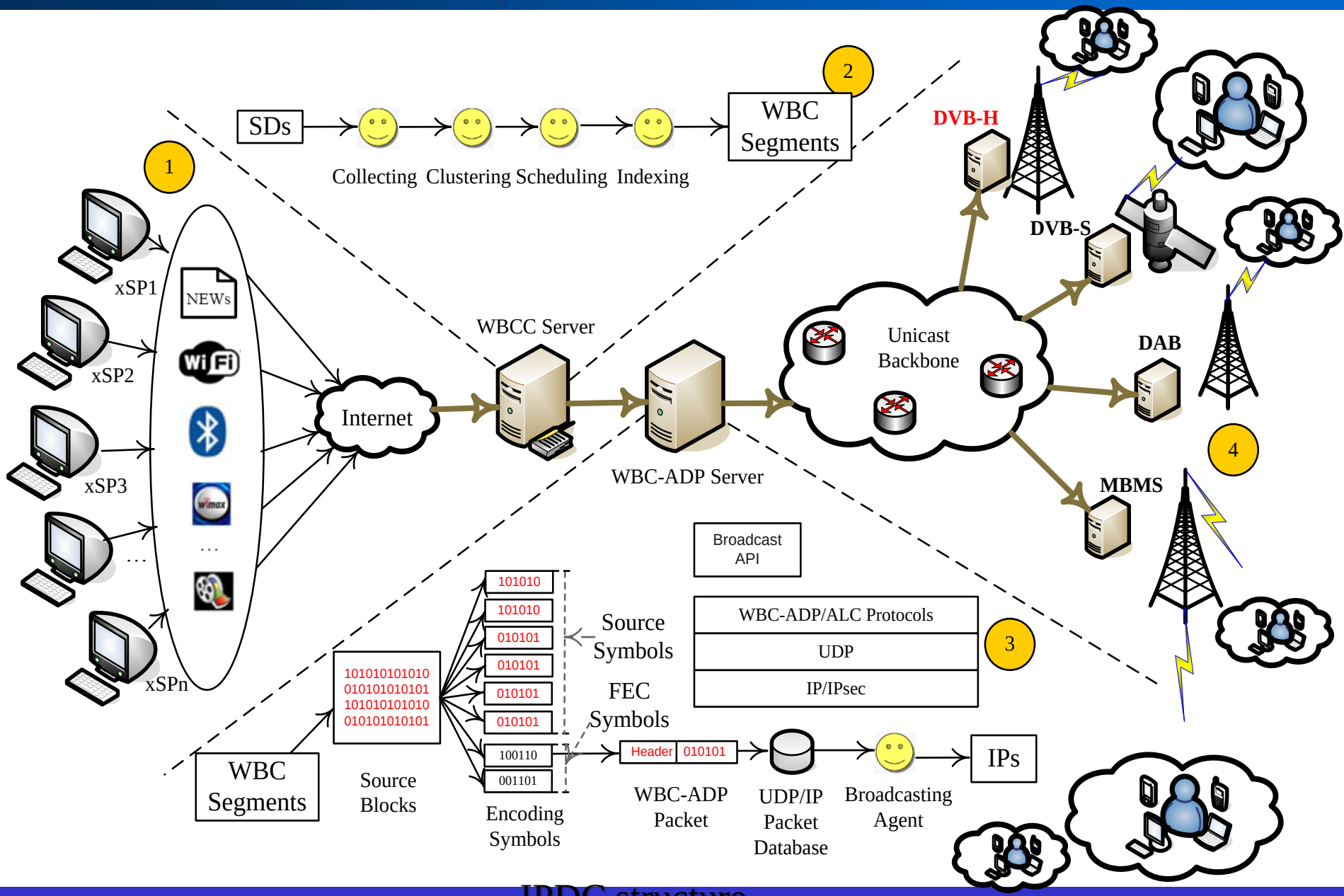
WBC: Carrier Technology

- What broadcast technology is best equipped to carry WBC channel on air?
- Several desired properties:
  - Very high level of coverage
  - Coverage should NOT be affected by mobility
  - Good indoor reception
  - Receiver should have minimal size, power requirements and manufacturing costs

WBC: Carrier Candidates

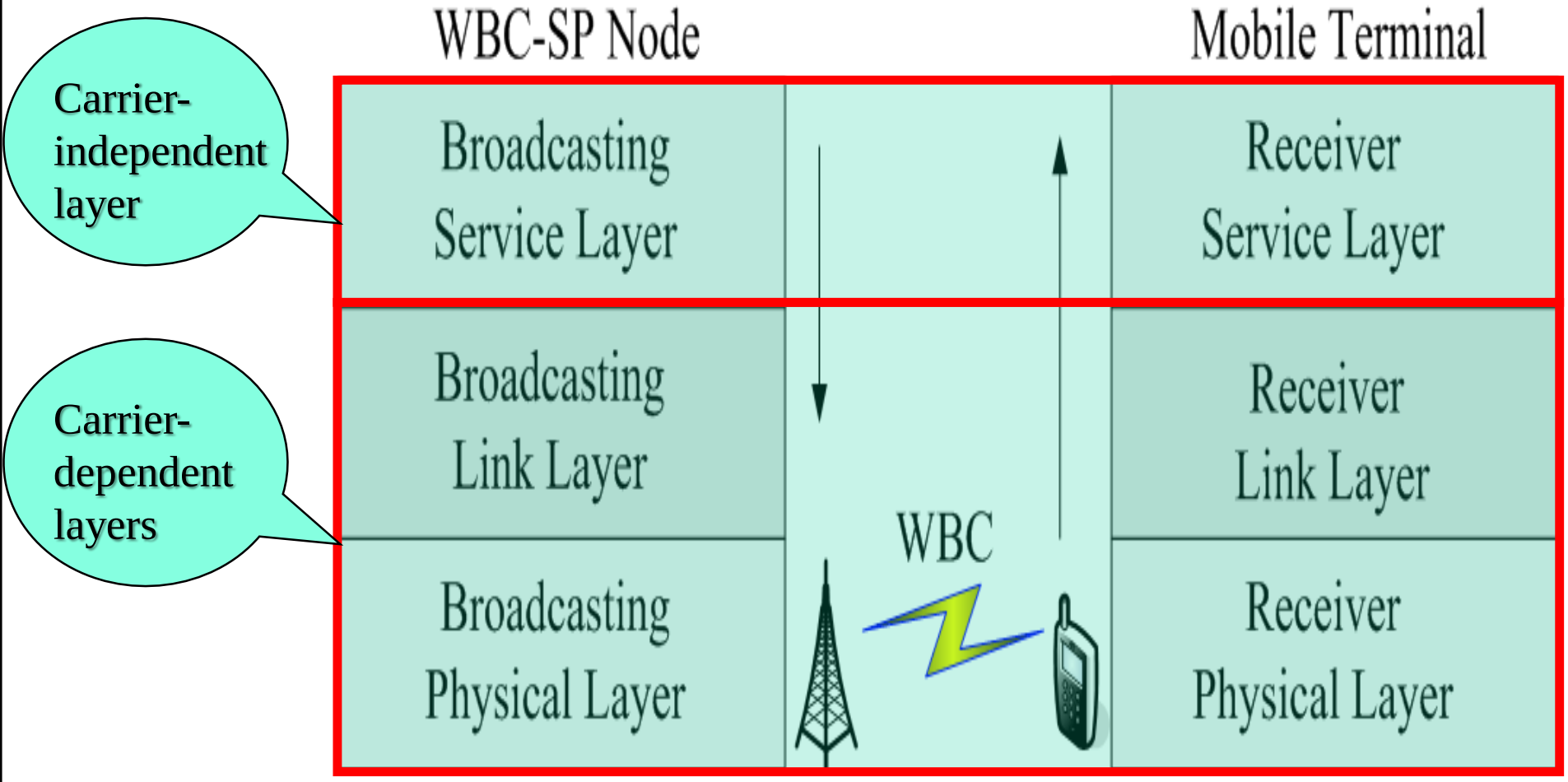
- **Terrestrial**
  - Digital Audio Broadcast (DAB)
  - Terrestrial Digital Multimedia Broadcast (T-DMB)
  - Digital Radio Mondiale (DRM)
  - Digital Video Broadcast for Handheld (DVB-H)
  - Multimedia Broadcast/Multicast Service (MBMS)
- **Satellite**
  - Satellite DMB (S-DMB)
  - Digital Audio Radio Satellite (e.g. WorldSpace, XM Radio, Sirius)
- **High Altitude Platforms (HAPs)**
  - Solar powered aircraft or airships providing quasi-stationary communication

WBC: System Architecture



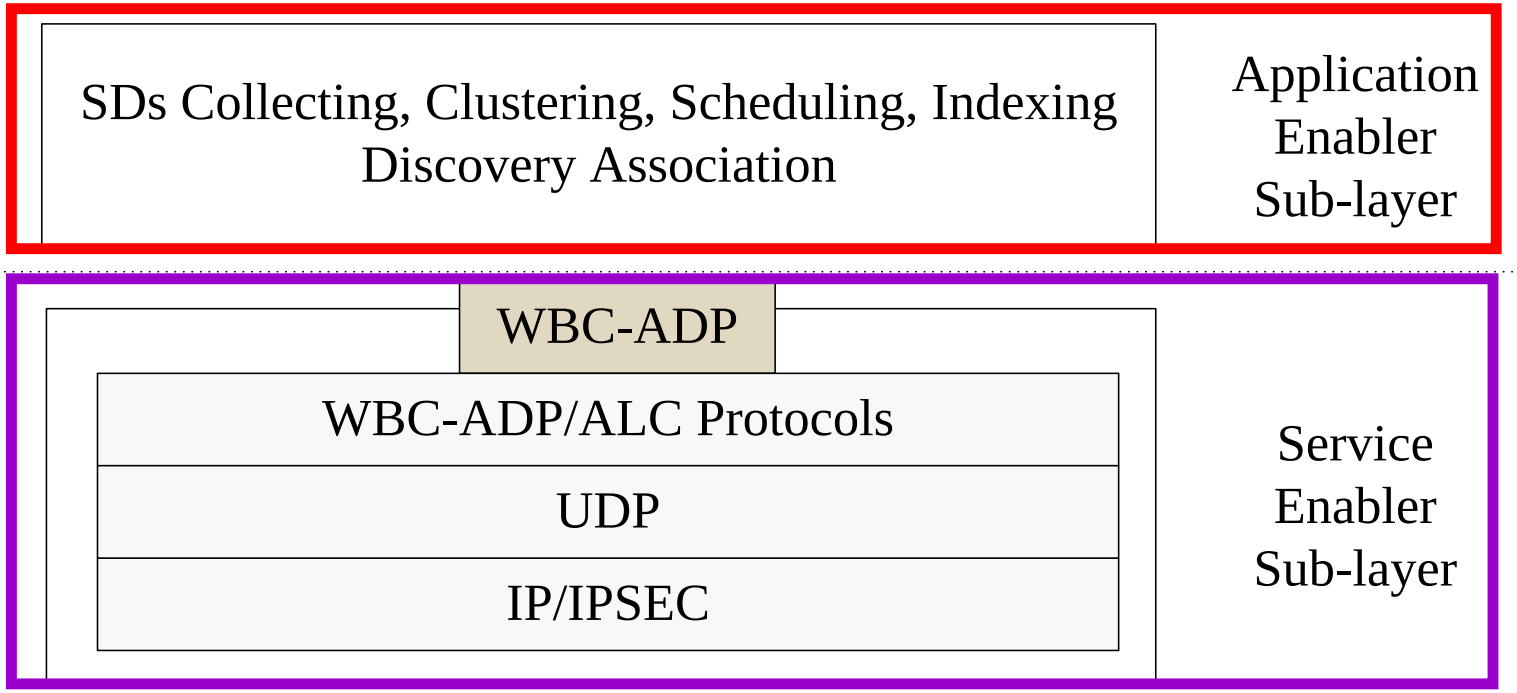
IPDC structure

WBC: Layered Model



WBC Service Layer: Goals

- Build up an efficient system for SD advertisement collecting, clustering, scheduling, indexing, discovery, and association.
- Enable IP datacasting of SDs – by means of a *novel* **Advertisements Delivery Protocol (ADP)**.



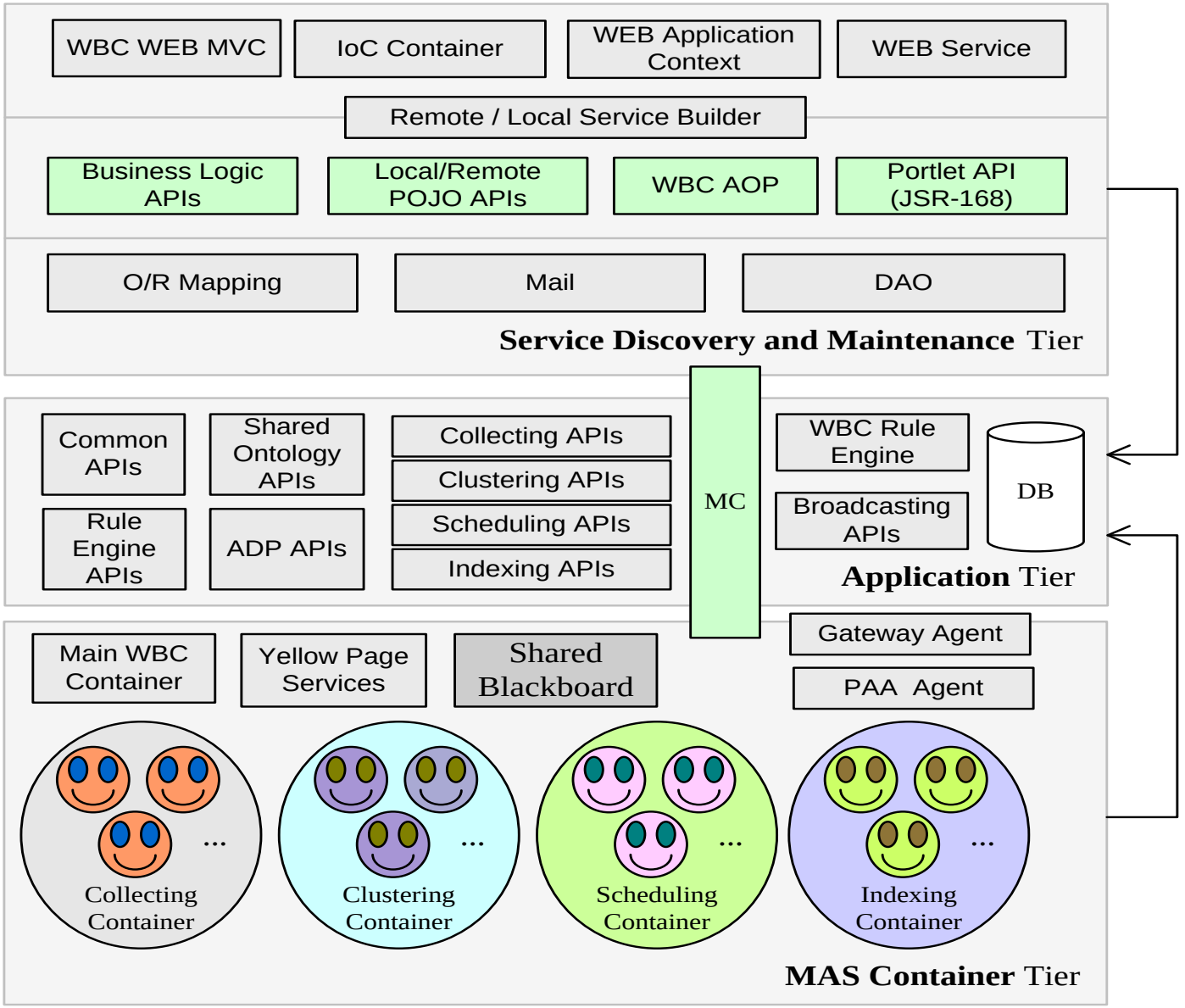
WBC Application Enabler Sub-Layer: Server Software Architecture

Built on three tiers:

1) Service Discovery and Maintenance tier (based on Java EE)
2) Application tier
3) MAS tier

Key properties:

- Java-based (for platform independence)
- Distributed (for flexibility)
- Multi-agent oriented (for extensibility)

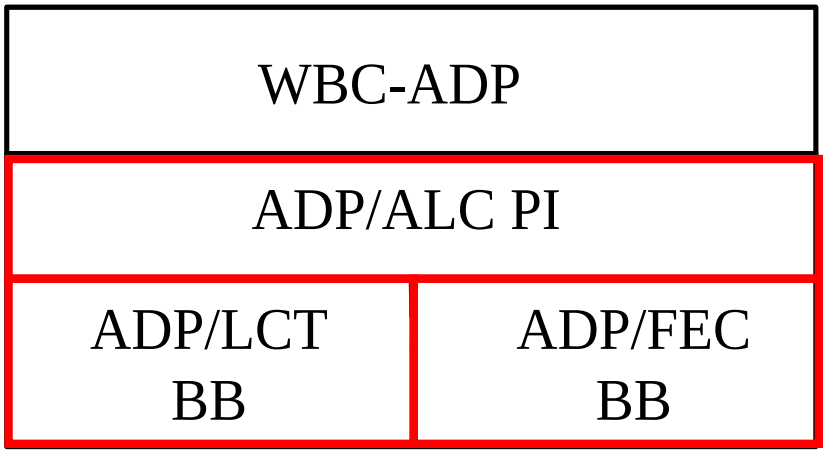


WBC Application Enabler Sub-Layer: Client UI

iWBC Android application UI

WBC Service Enabler Sub-Layer:
Advertisements Delivery Protocol (ADP)

- To smooth the IPDC processing in WBC, a new reliable and scalable ADP protocol was elaborated (based on the standard ALC protocol) to convert WBC segments into IP packets.
- 2 modified BBs (Layered Coding Transport, LCT and FEC) and 1 modified Asynchronous Layered Coding (ALC) PI were developed for ADP.

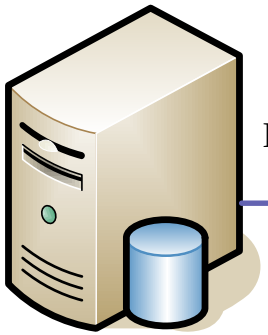


The ADP Building Block Structure

WBC Link- & PHY Layers: Goals

- DVB-H as a pilot WBC carrier
- Improve the DVB-H reliability
  - 2 new decapsulating & decoding algorithms developed and tested:
    - Smart Section Erasure (SSE)
    - Smart Transport Stream Erasure (STSE)
- Build a testbed
  - In software: for performance evolution
  - In hardware: for ‘proof-of-concept’ demonstration

WBC: Testbed

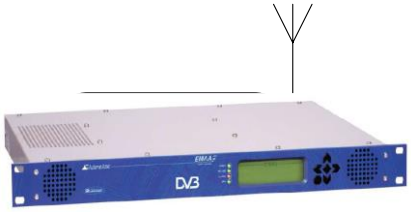


WBC Content Server
(Computer)

IP Packages

DVB-H
Encapsulator
(IPE10)

TS



DVB-H
Transmitter
(EMAA)

WBC

Mobile Teminal
(Laptop, MIDP, Android)

IP Packages

DVB-H
Decapsulator
(POD-1100)

TS

DVB-H
Demodulator
(POD-1100)

WBC: Inputs to ITU-R reports

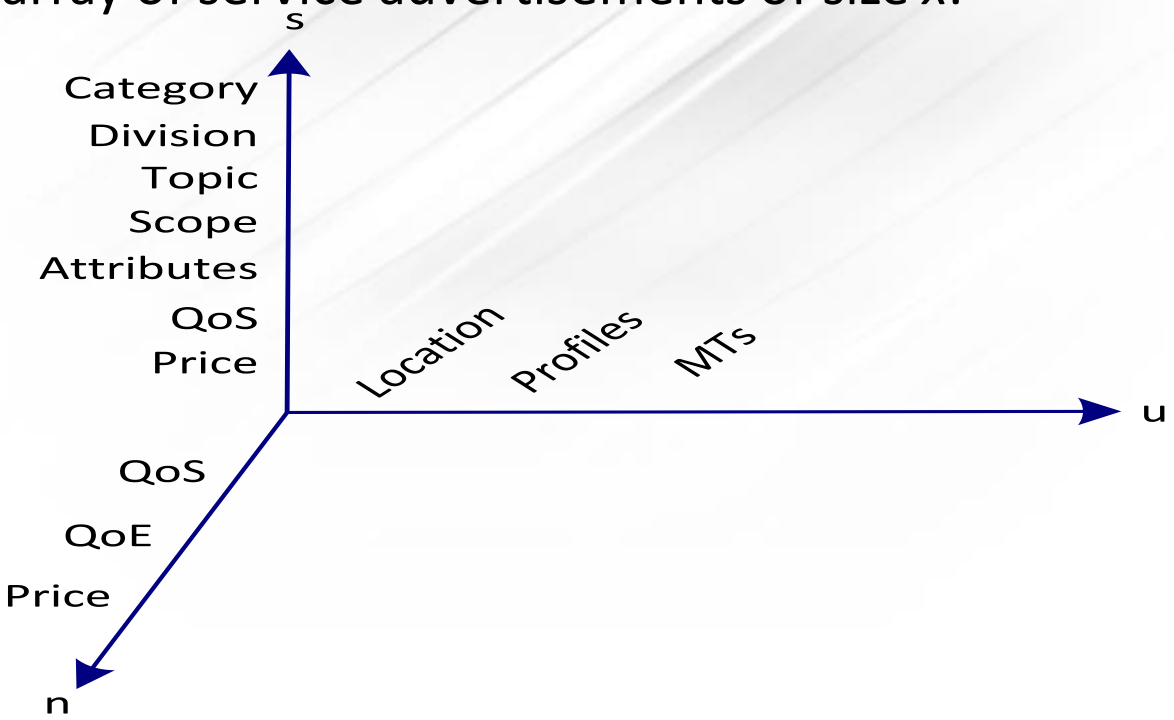
- 5A/437-E (27 Jan 2014)
  - **IMPLEMENTATION EXAMPLES OF A CPC PIGGYBACKED ON A BROADCAST DIGITAL PLATFORM**
- 5A/438-E (27 Jan 2014)
  - **WIRELESS BILLBOARD CHANNELS (WBC) – AN EXAMPLE OF WIRELESS CONTROL CHANNELS**

UCWW: Service Recommendation System (SRS)

- **Aim:** To enable MUs to discover and associate with 'best' services under the always best connected and best served (ABC&S) paradigm.
- **Mathematical model:** The selection of the 'best' service ***s*** for user ***u*** in the network context ***n*** is based on finding the maximum value of:

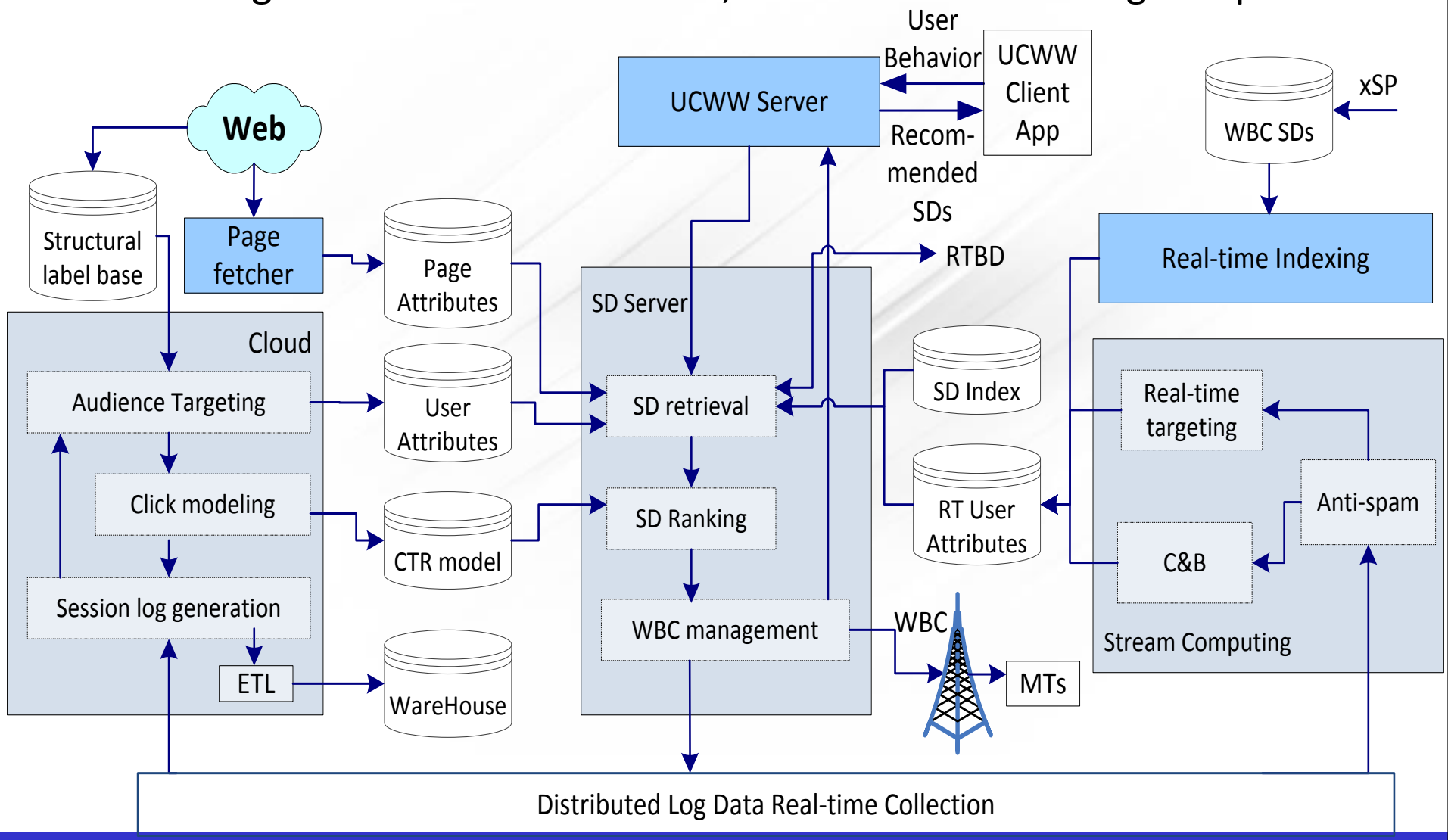
$$Max_{s_1 \ldots x} \sum_{i=1}^{n} Best(\mathrm{s}_i, \mathrm{u}_i, \mathrm{n}_i)$$

- **Output:** An array of service advertisements of size *x*.



UCWW: SRS Structure

A modular structure has been adopted with 4 components: SD server, cloud, distributed log data real-time collection, and real-time indexing component.

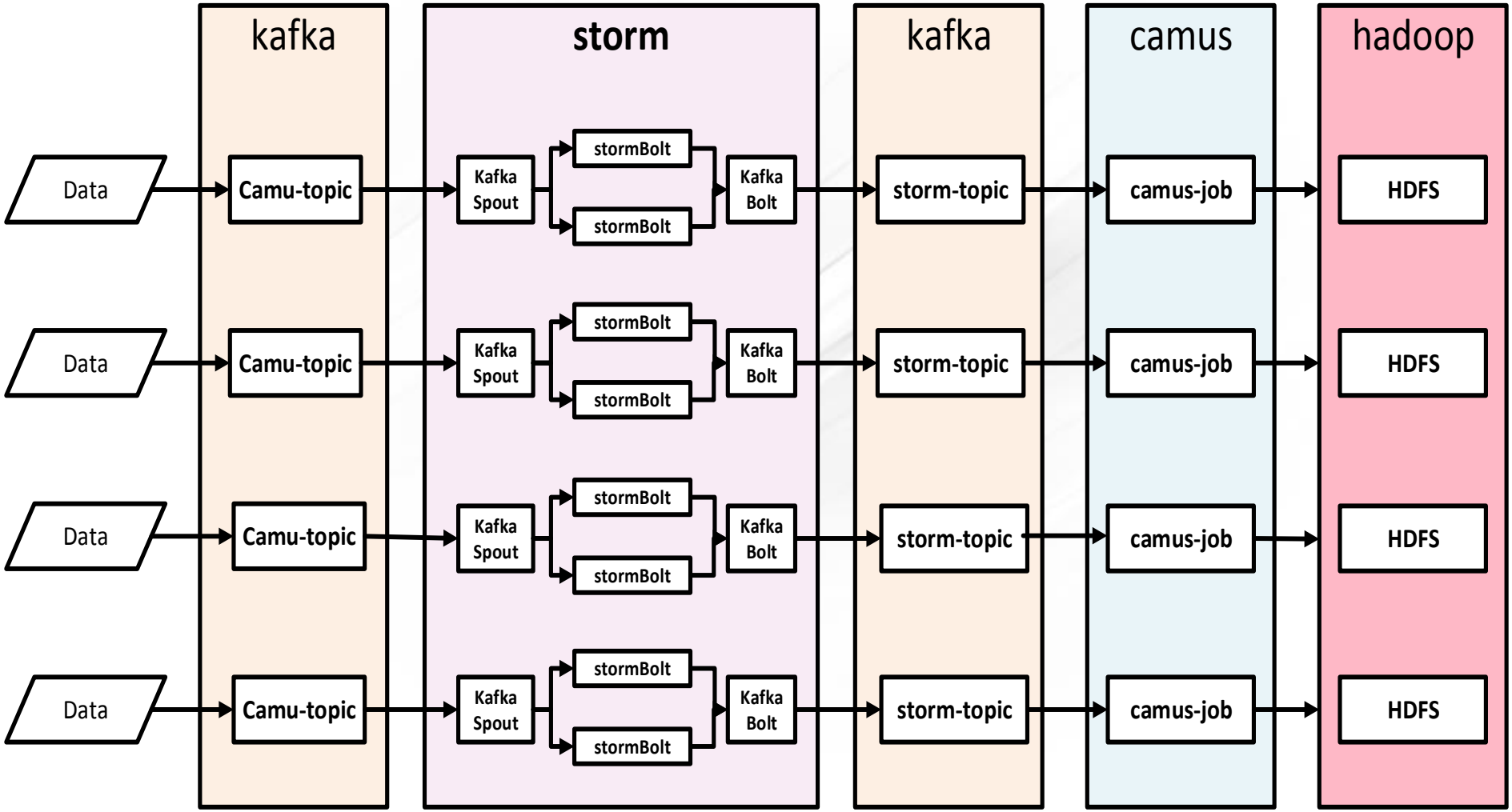


WBC/SRS: Research

- Development of a UCWW Warehouse using Hadoop 2

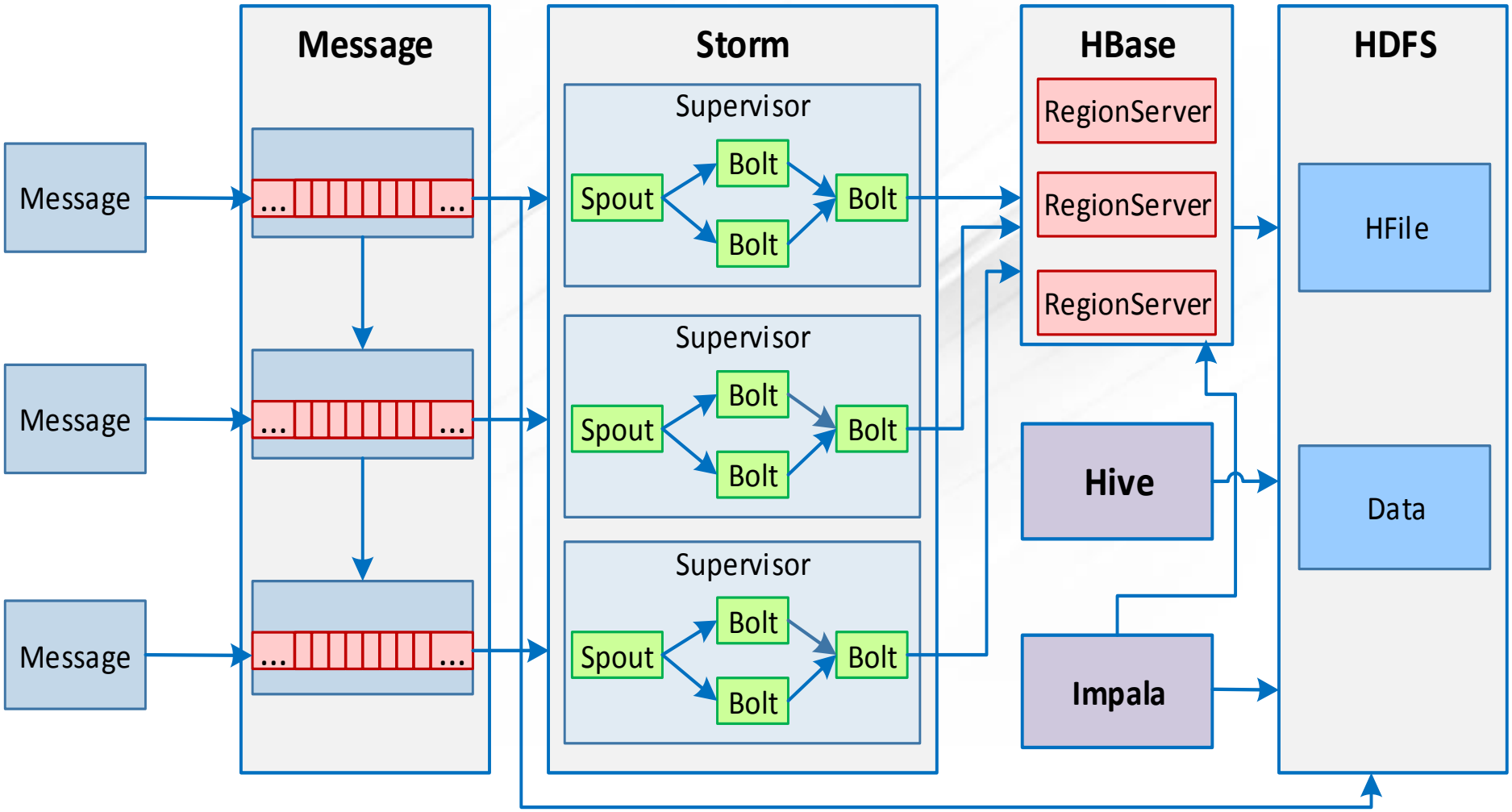
  Main tools: Kafka, Storm, Kafka->HDFS pipeline

  Goal: Automatic discovery of topics, processing billions of messages per day.



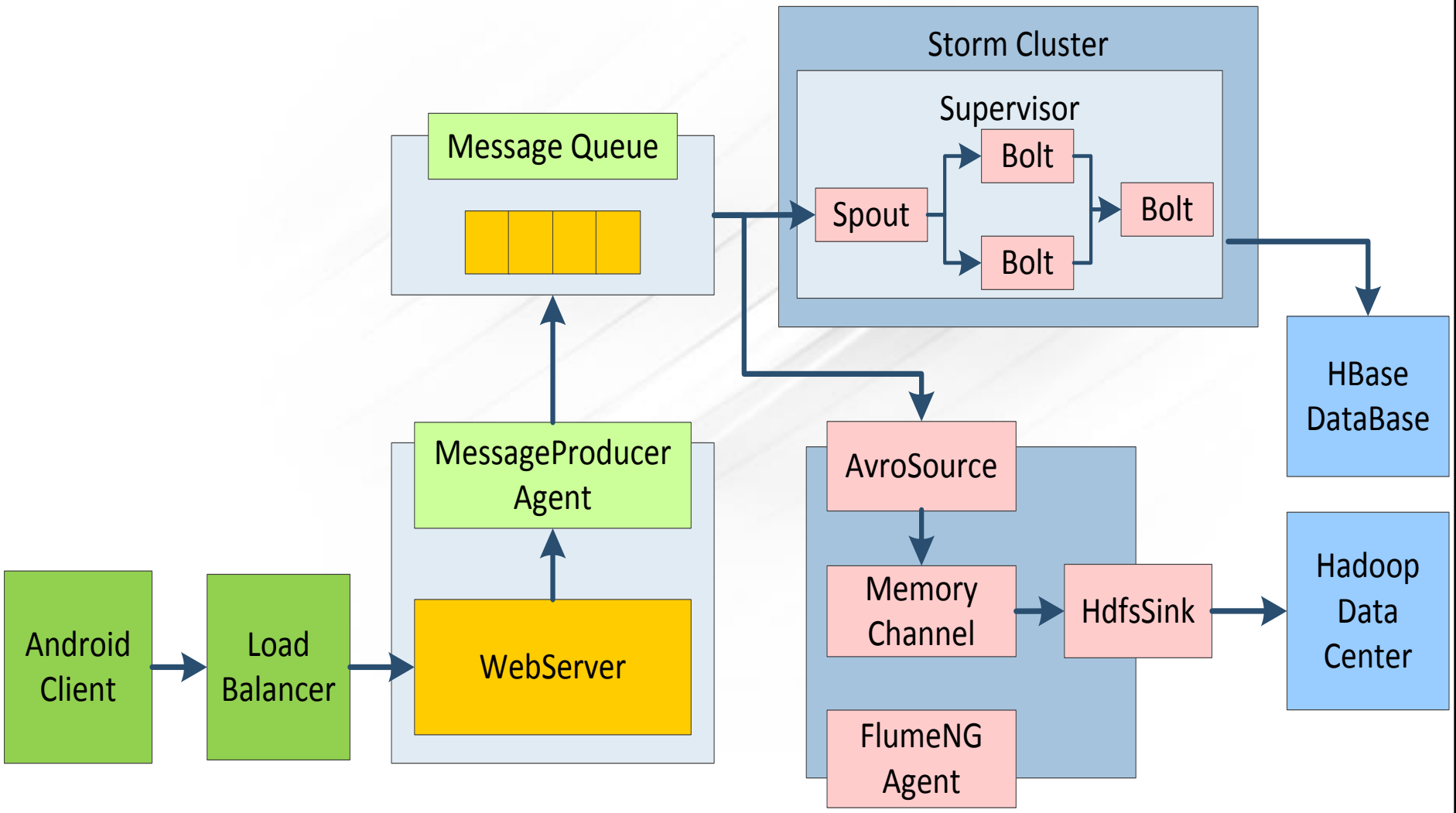
WBC/SRS: Research (cont.)

- UCWW Hadoop 2 based Cloud Middleware
- Hadoop 1 middleware updated to Hadoop 2 YARN (new version of Map/Reduce)



WBC/SRS: Research (cont.)

- UCWW Distributed Message System updated to Hadoop 2
- Distributed No-SQL database system development with Zookeeper



CBM Techno-Requirements (cont'd)

New architectural entities, technical and standardization innovations *cont'd*

- **Incoming Call Connection (ICC) service**
  - ICC-SPs
    - *Not ANPs*
  - Will require a matching (peering) access network ICC entity
  - Global standardization for *ICC protocols*
  - Purely oriented to consumer's requirement
  - Based on a third-party architecture
  - Providing ***personalized*** service
  - Intelligent Call Management with regard to different user's preferences

CBM & Incoming Call Connection service

Incoming **C**all **C**onnection service (***ICC***):

- Key and very important service & business model issue
- Legacy & foundation of SBM

Observations:

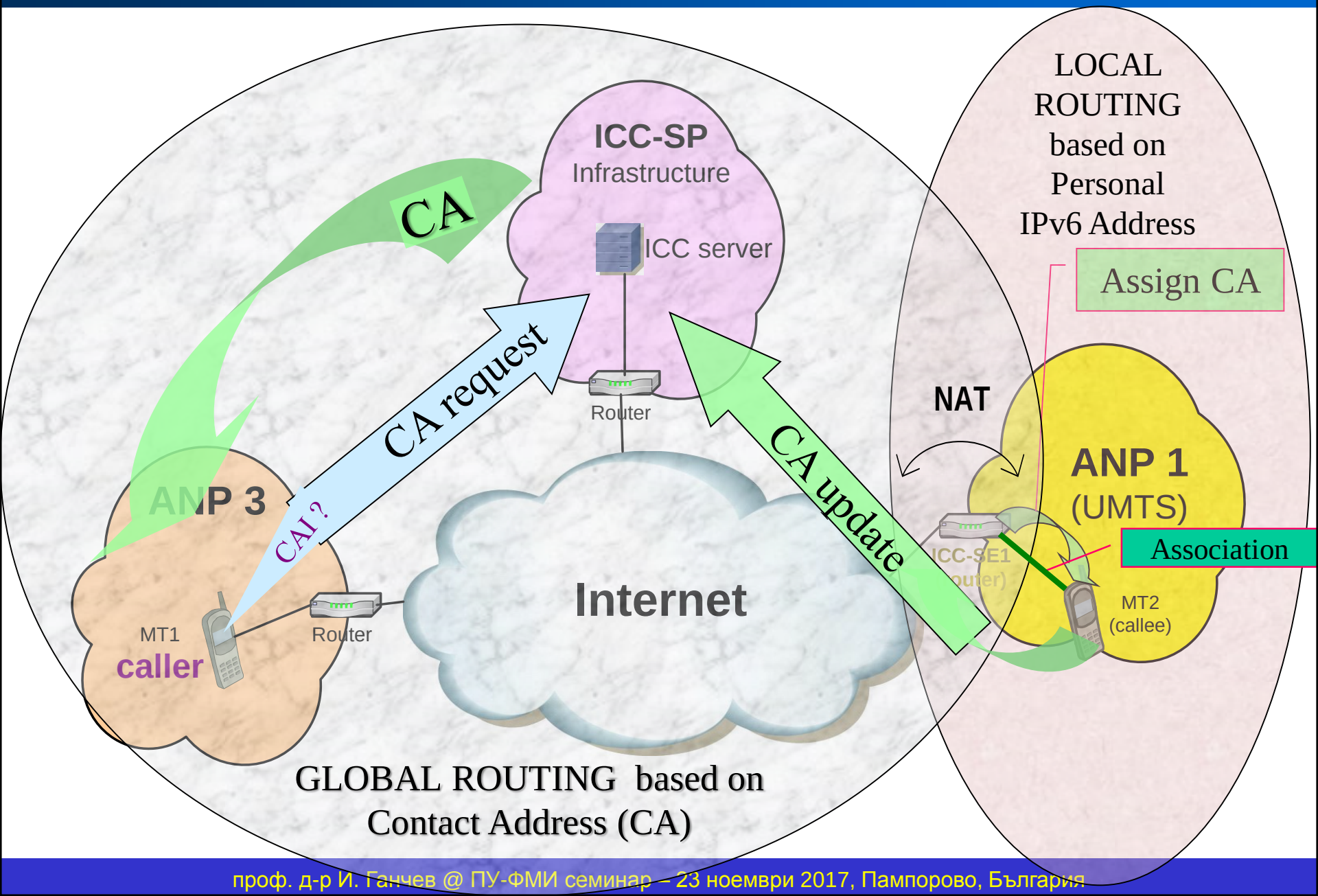
1. For CBM: a number of solutions are possible
   - E.g. following the thinking of HMIP, but with distinct **differences**.
2. **NOT** the defining service it was !
   - ICC is **NOT required** for most Internet services
     - E-commerce, e-government, e-education, etc.
     - Browsing, content downloading, etc.
     - Most non-real-time services (e.g. e-mail)
   - **Its power to determine the business model is weakening**
     - Example of evidence for this today:
       - » Non-cellular commercial wireless Internet access
       - » Cellular companies getting into Wi-Fi
       - » Cellular parents competing with their daughters

CBM: Consumer-oriented ICC

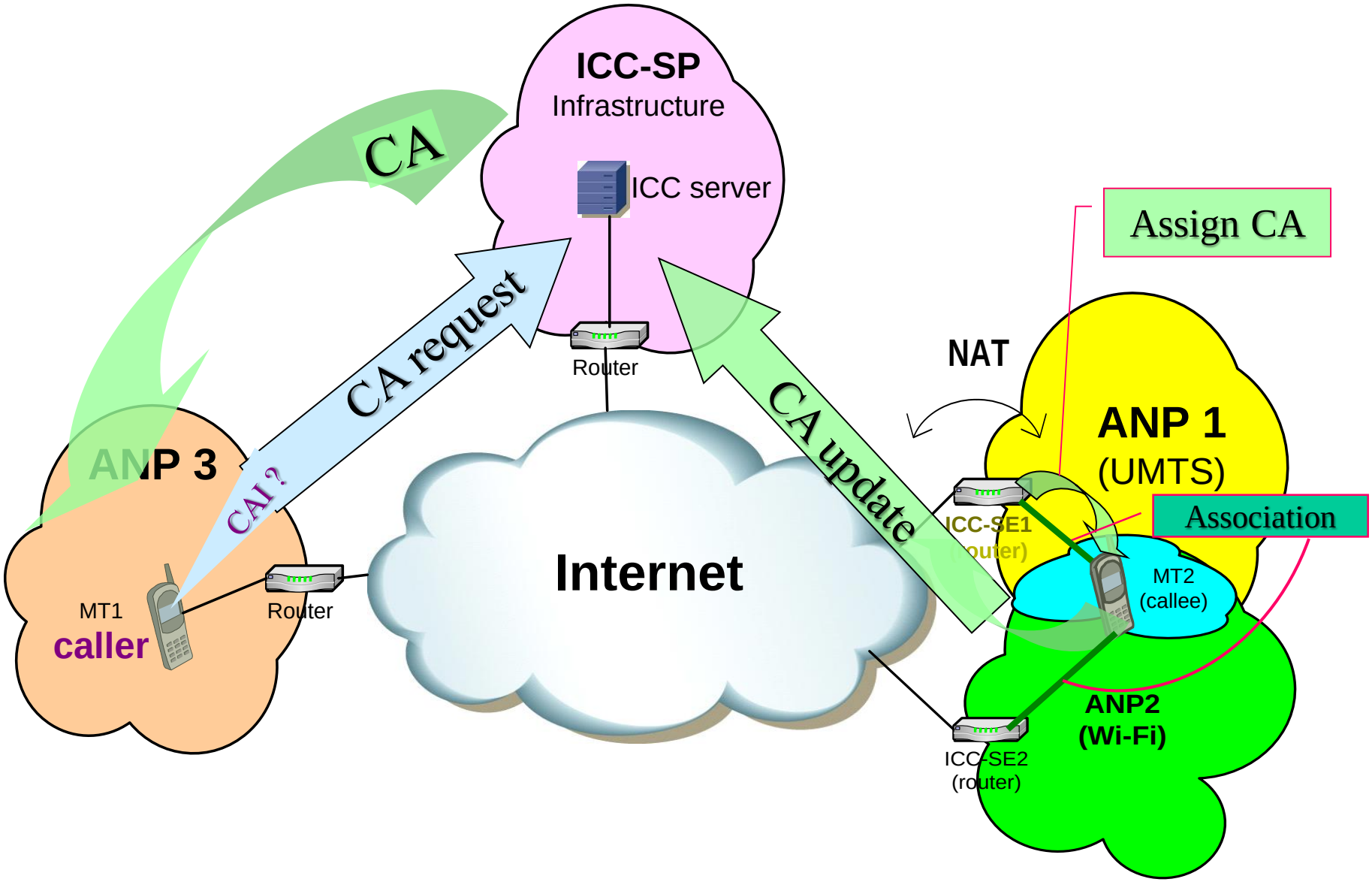
- NOT having a fixed point of attachment how can a consumer receive incoming calls?
  - SBM strength
  - To be re-invented

- Creation of a new business entity
  - **Incoming Call Connection (ICC) Service Provider**
    - Outside the access networks **- autonomous**
    - **Lynch-pin** for Incoming Call Connection (ICC) service
  - Operation based on
    - **Contact Address (CA)** scheme
      - Globally routable, temporary, forwarding IP address
    - **Contact Address Identifier** (**CAI**)

CBM-ICC: Service Operation



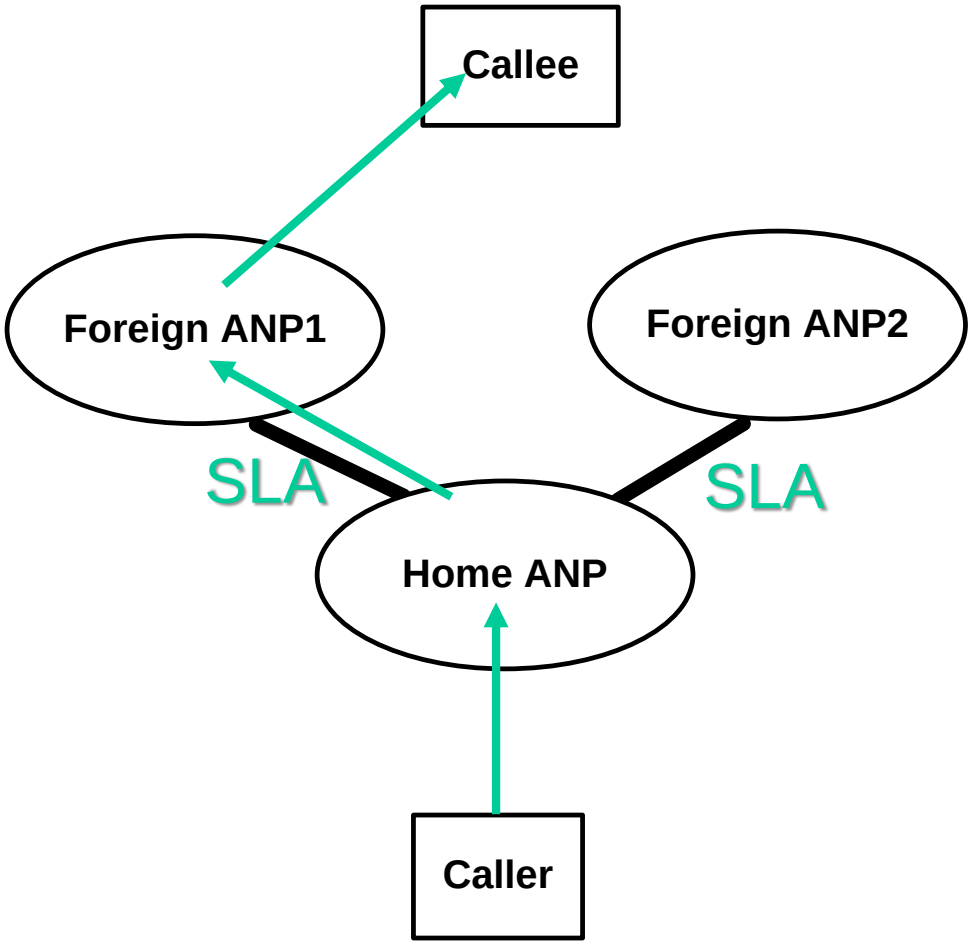
CBM-ICC: Service Operation (cont.)



CBM-ICC Service

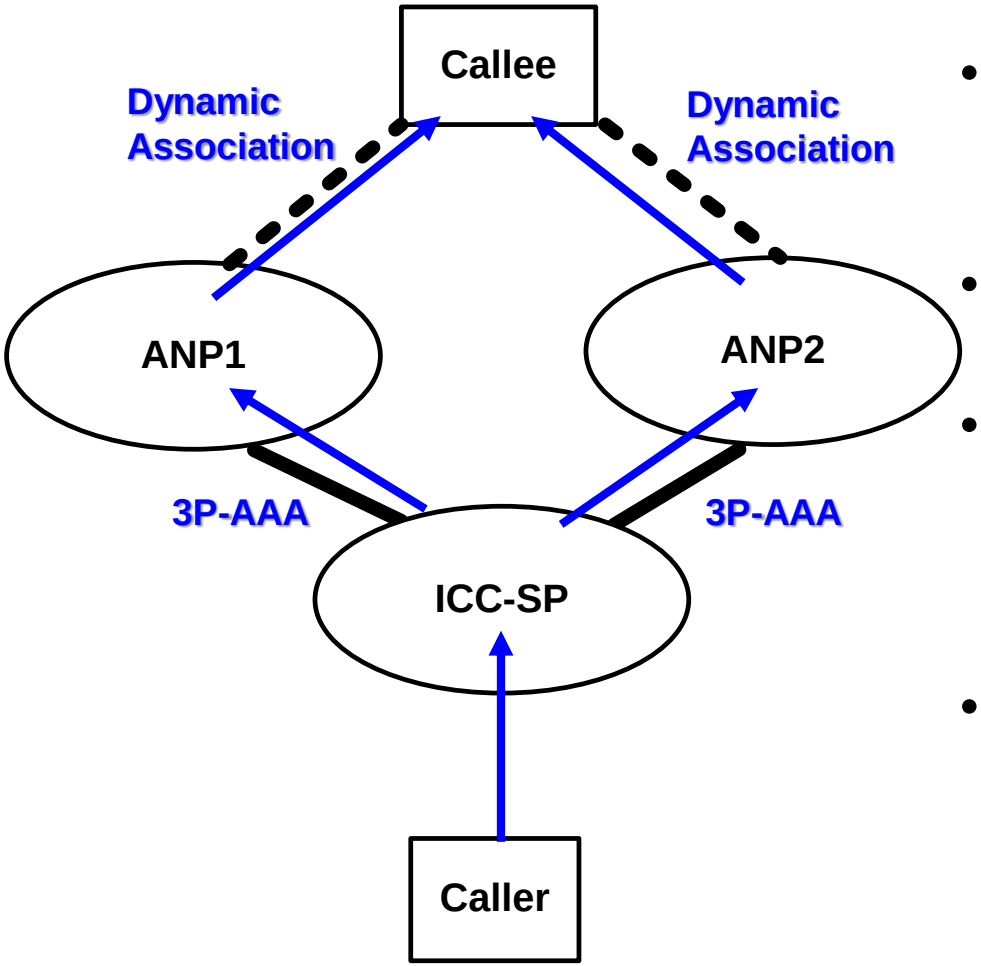
- Standardization
  - ICC interface architecture
  - ICC signalling protocol
- **Business Development Opportunities**
  - New entities - ICC service providers
  - Provision of user-friendly, flexible, specialized and customized ICC management services for
    - Individuals, groups and corporations
- **Social Impact**
  - Full freedom of consumer choice, e.g.
    - Which networks to use for these services at any location or time
    - Opportunity to match which ANP to use for which caller; etc.
  - Consumer communications management
    - Enhanced, new possibilities, customization, dynamic & adaptive, e.g.
      - » ICC service to be dynamically matched to consumer roles and profiles.

Traditional SBM-ICC Service



- SBM-ICC service has many disadvantages
  - NOT flexible enough to support future UCWW
  - The roaming is complex and costly
  - NO advanced call control

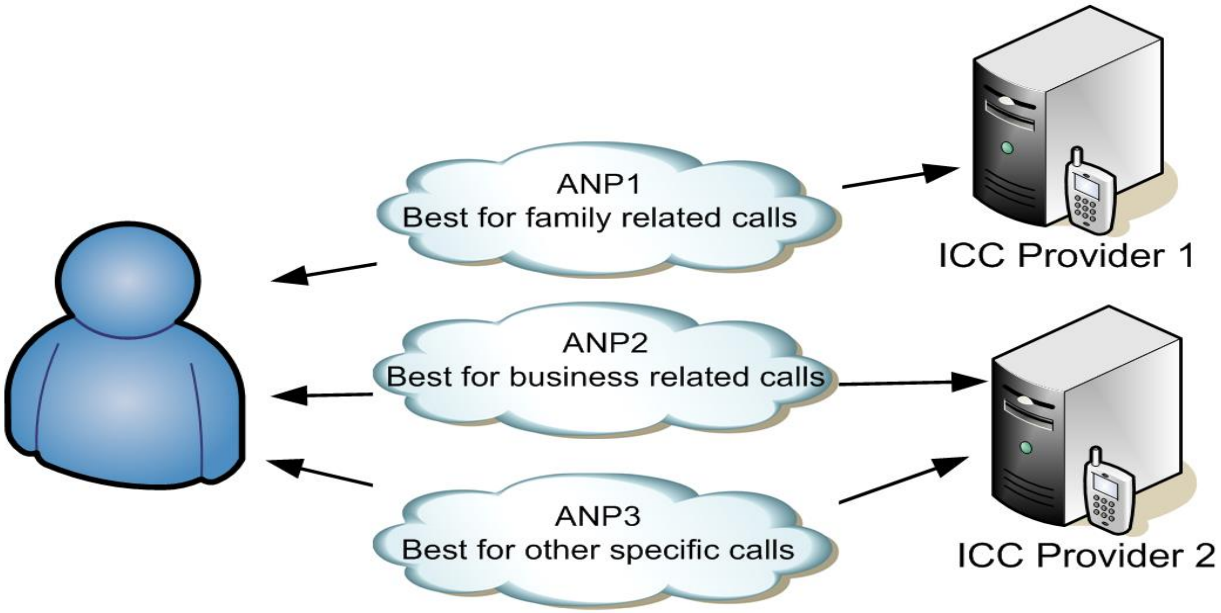
CBM-ICC Service is Different



*This figure only illustrates the management of how connection can be made

- MU (callee) acts like a consumer with a unique identifier to receive incoming calls via any ANPs
- Callee may dynamically associate with more than one ANPs
- Incoming calls go directly to ICC-SP, which manages these calls to the MU's 'current' location
- Users may always appear as local to whatever ANP they seek services from, paying for these services through a 3P-AAA-SP
- The real connection can be made outside the ICC-SP

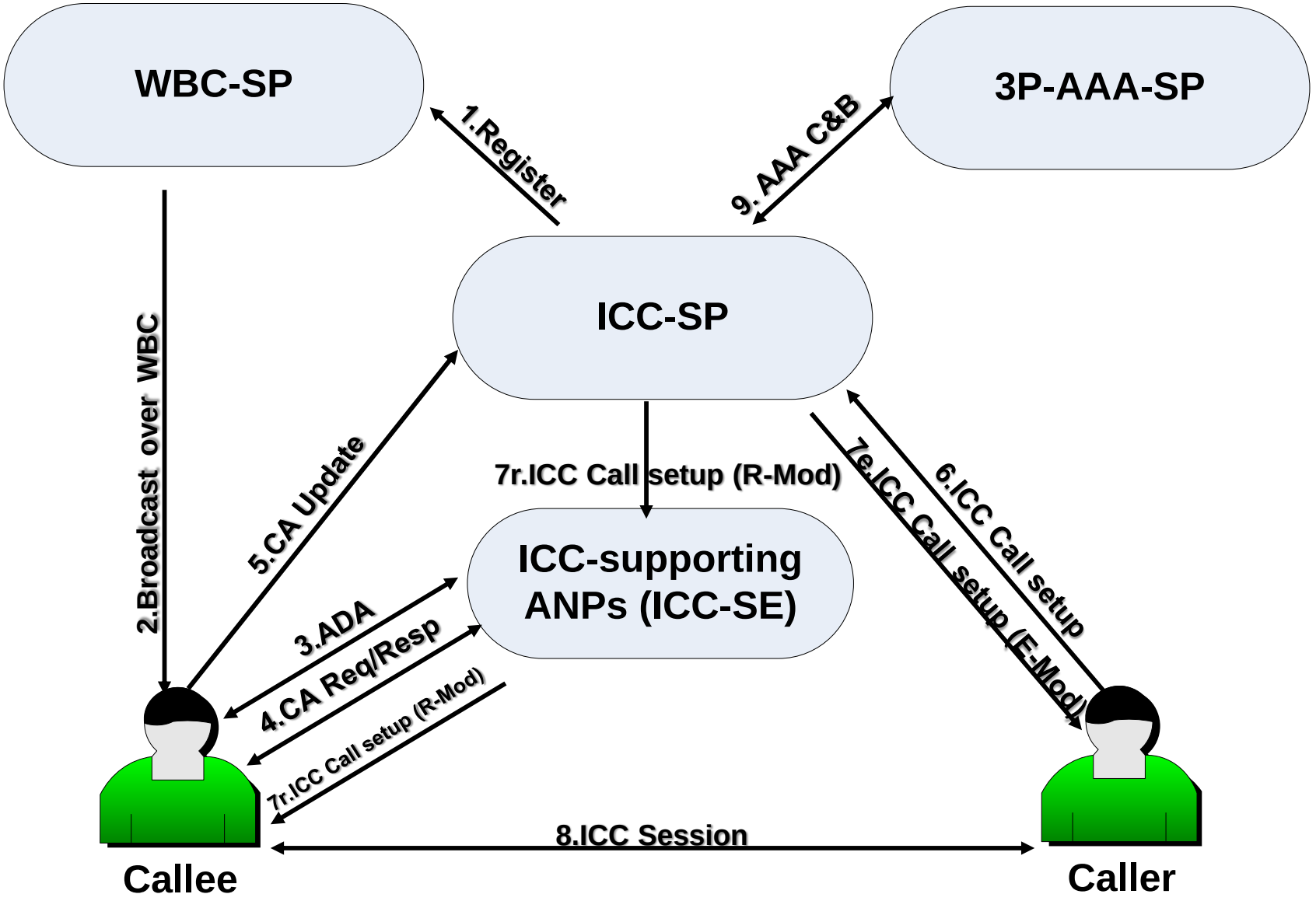
CBM-ICC: Key Innovations



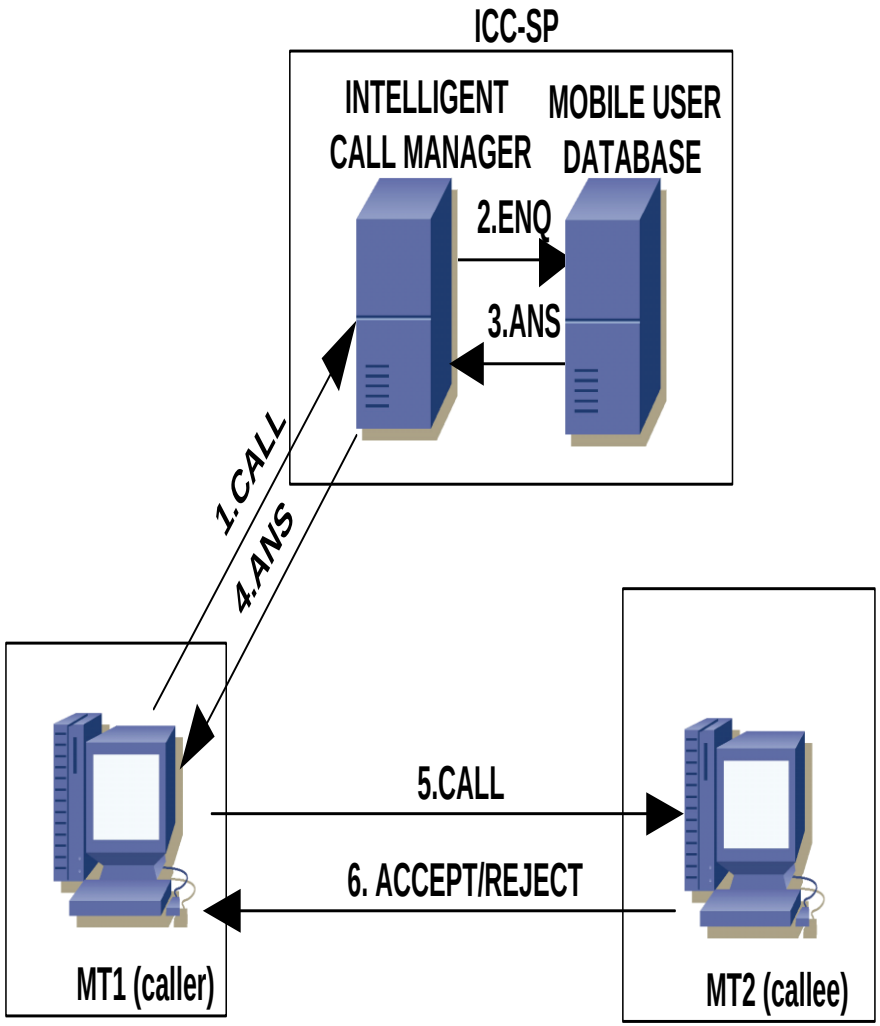
CBM-ICC service is a natural evolution of SBM-ICC service with:

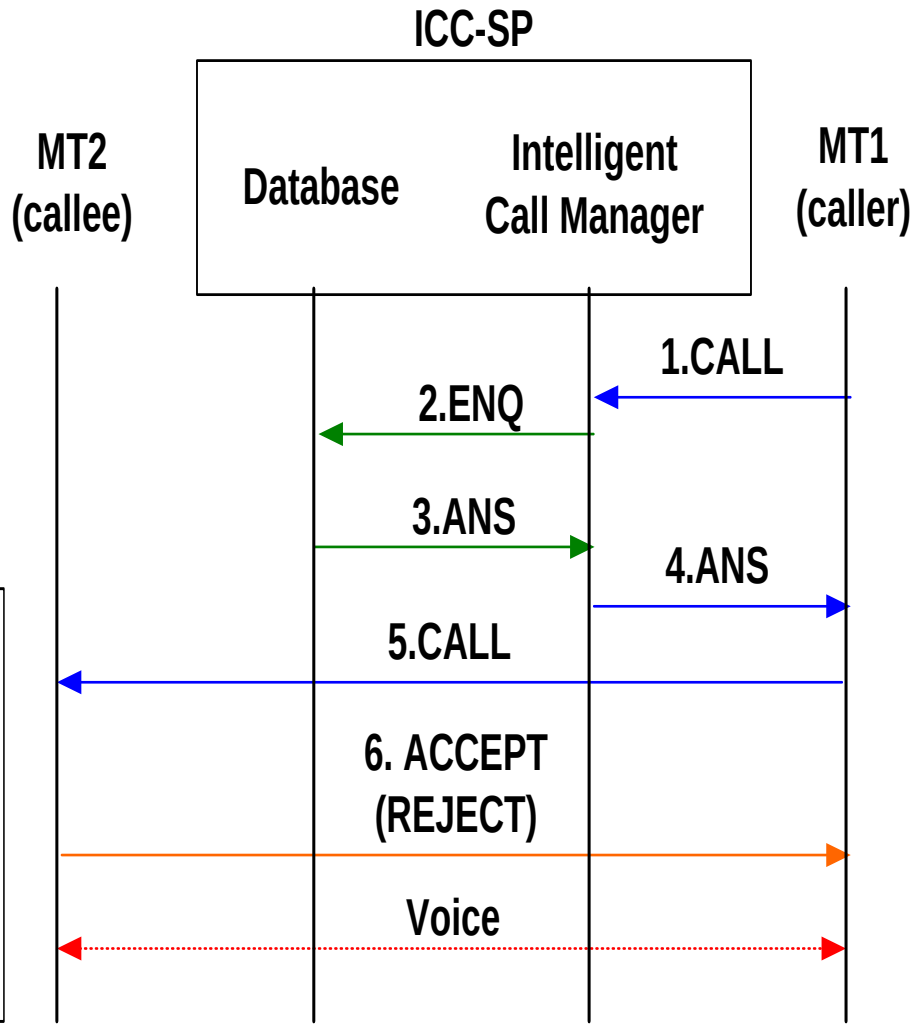
- Flexible and personalized Intelligent Call Management (ICM)
- Better support for multiple and heterogeneous ANPs
- Support for Hot Access network Change (HAC)
- Reduced roaming costs
- Open environments to allow more competitive new ANPs and xSPs enter the market

CBM-ICC: Operational Demonstration

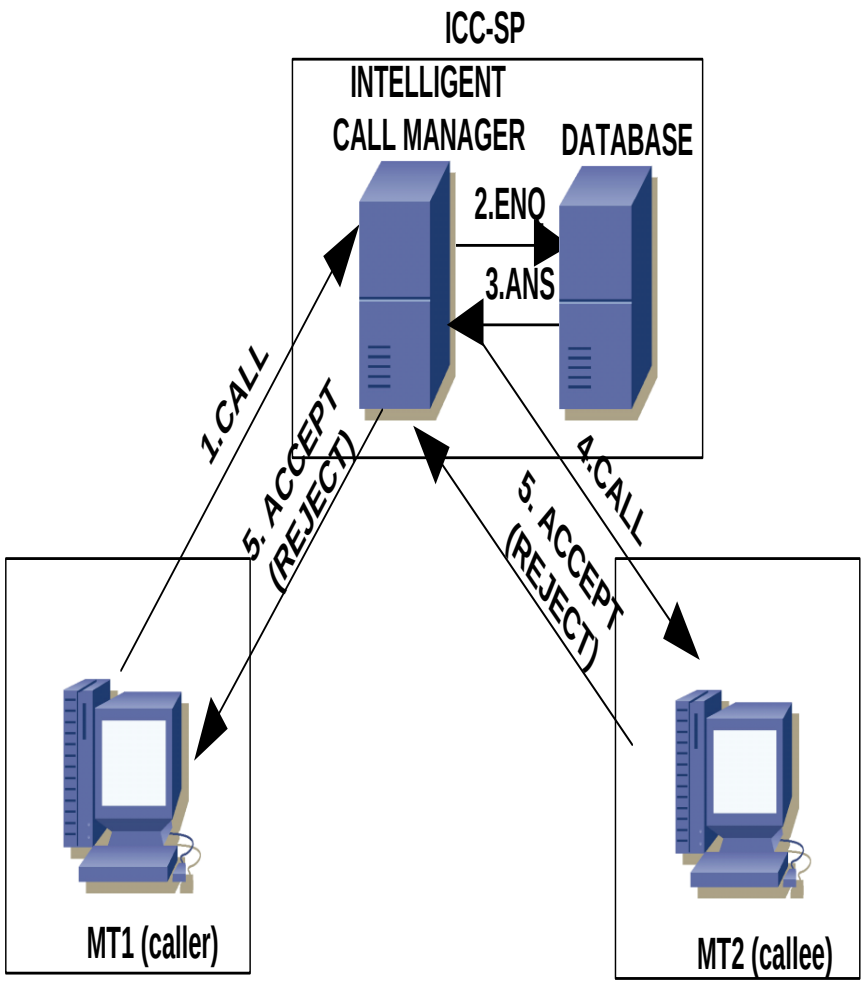


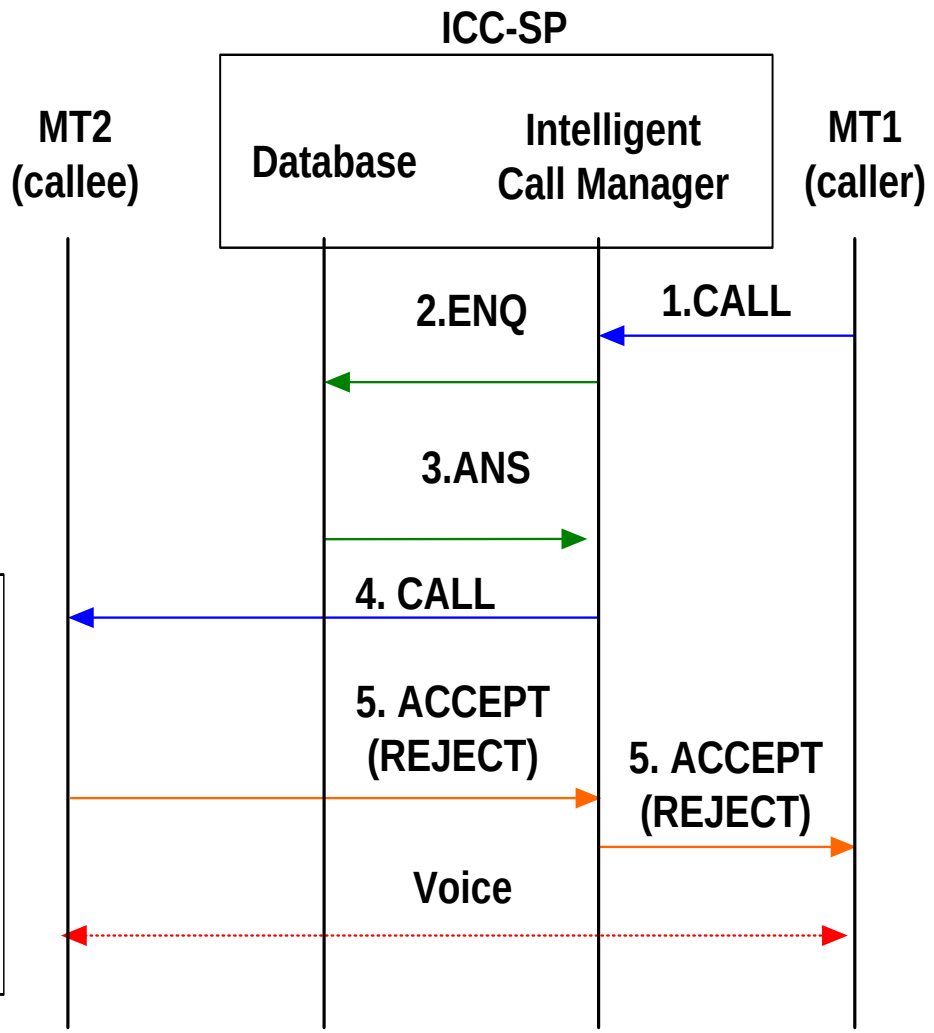
CBM-ICC: Enquiry Mode



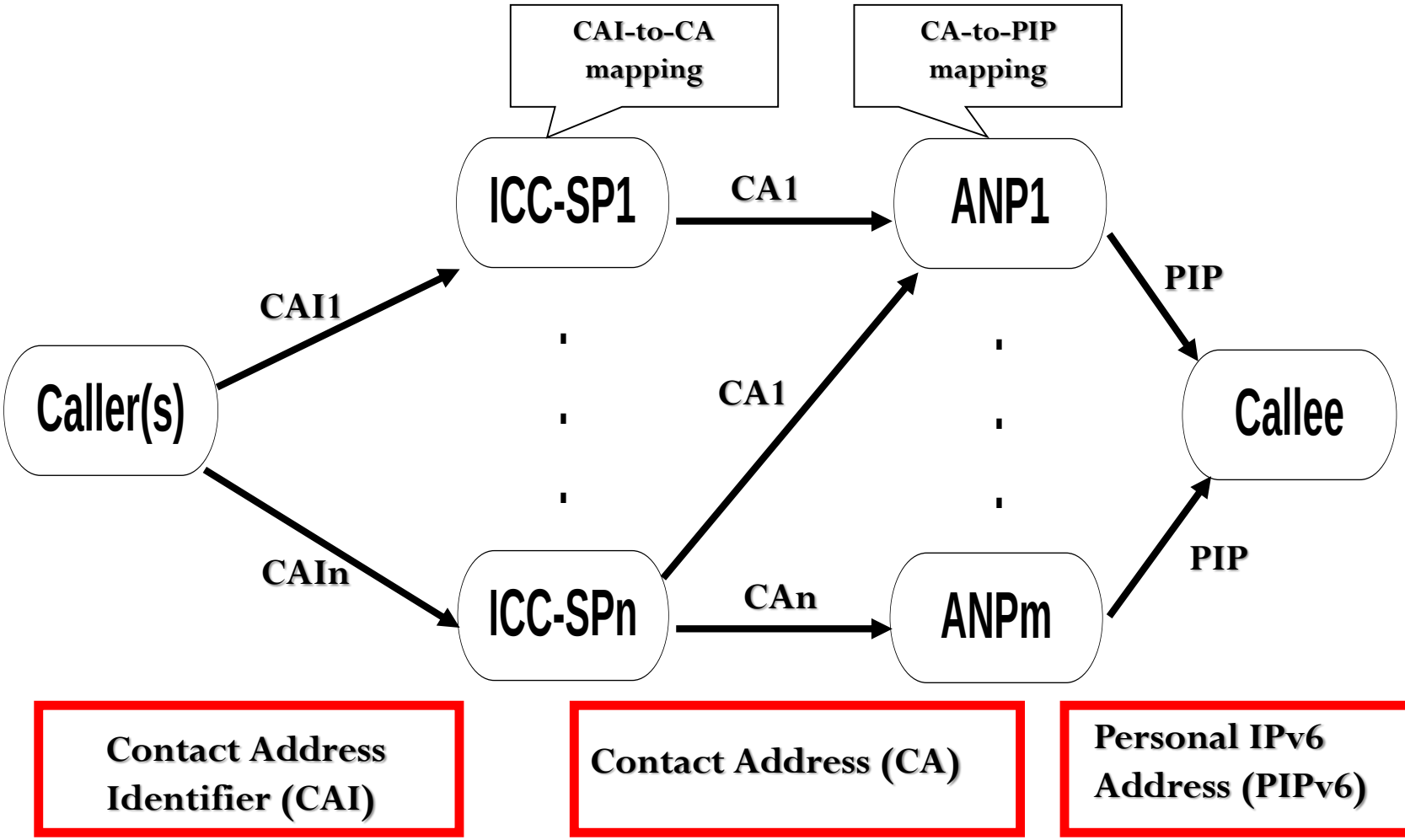


CBM-ICC: Redirection Mode

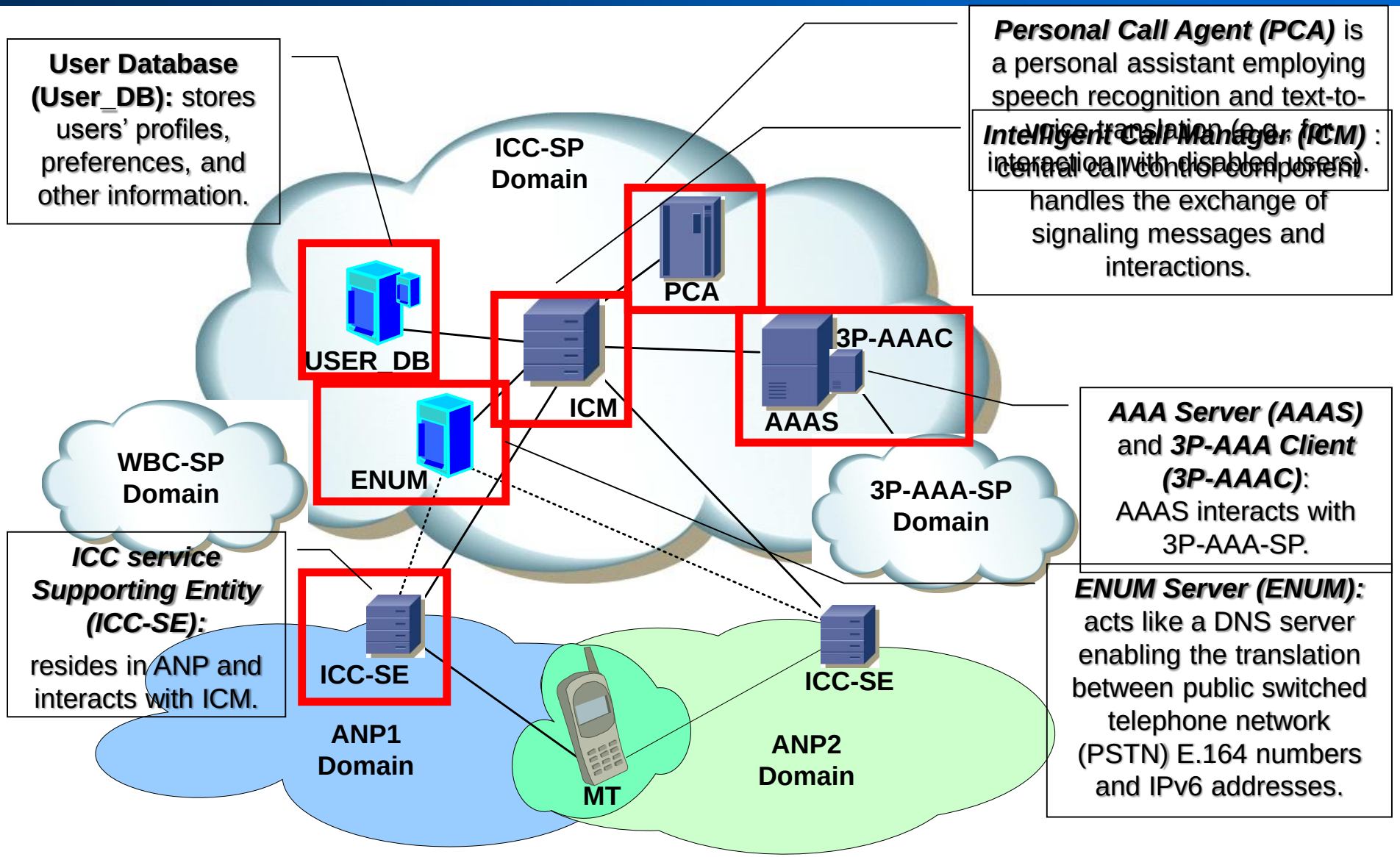




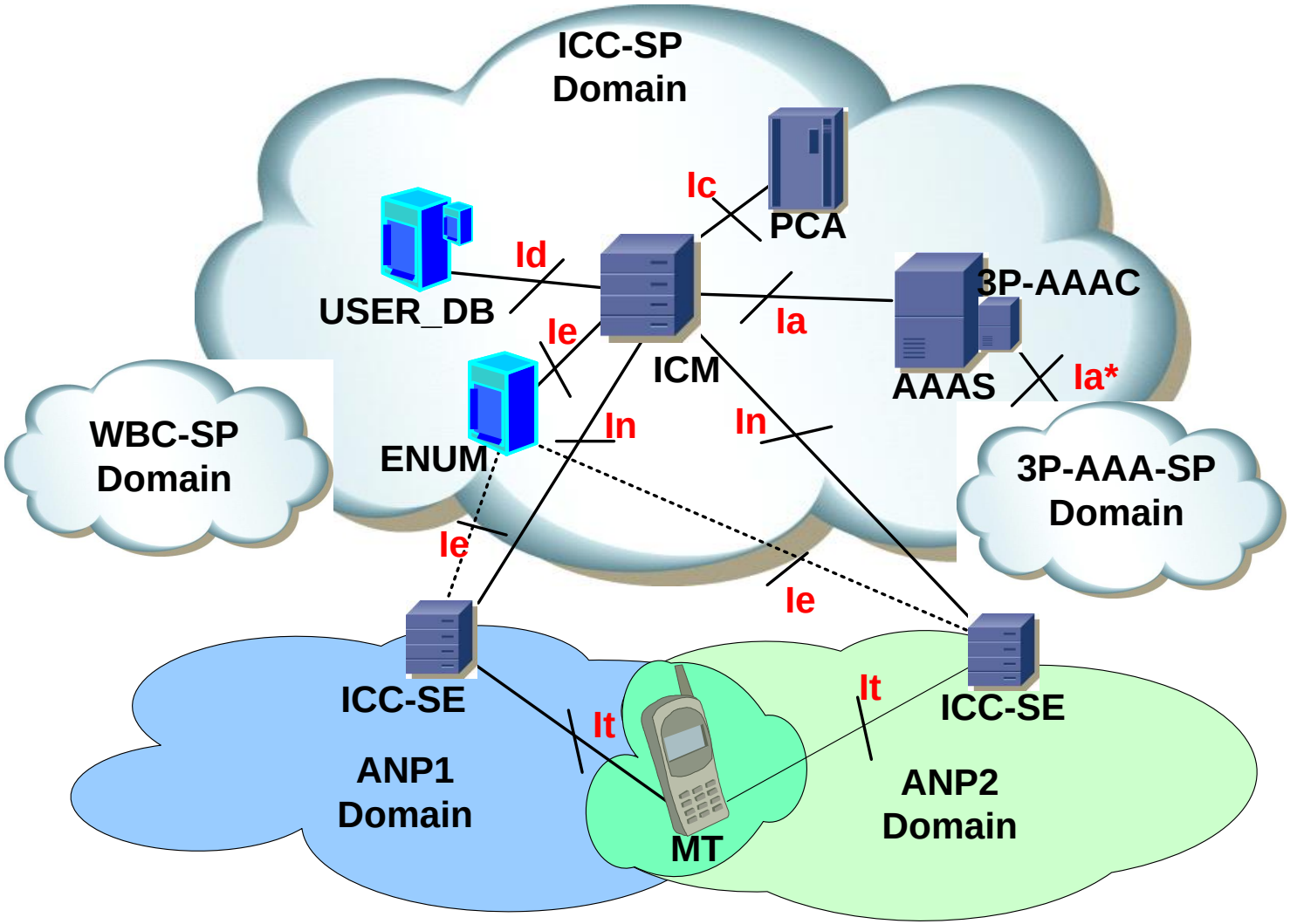
CBM-ICC: Addressing



CBM-ICC: Service Architecture



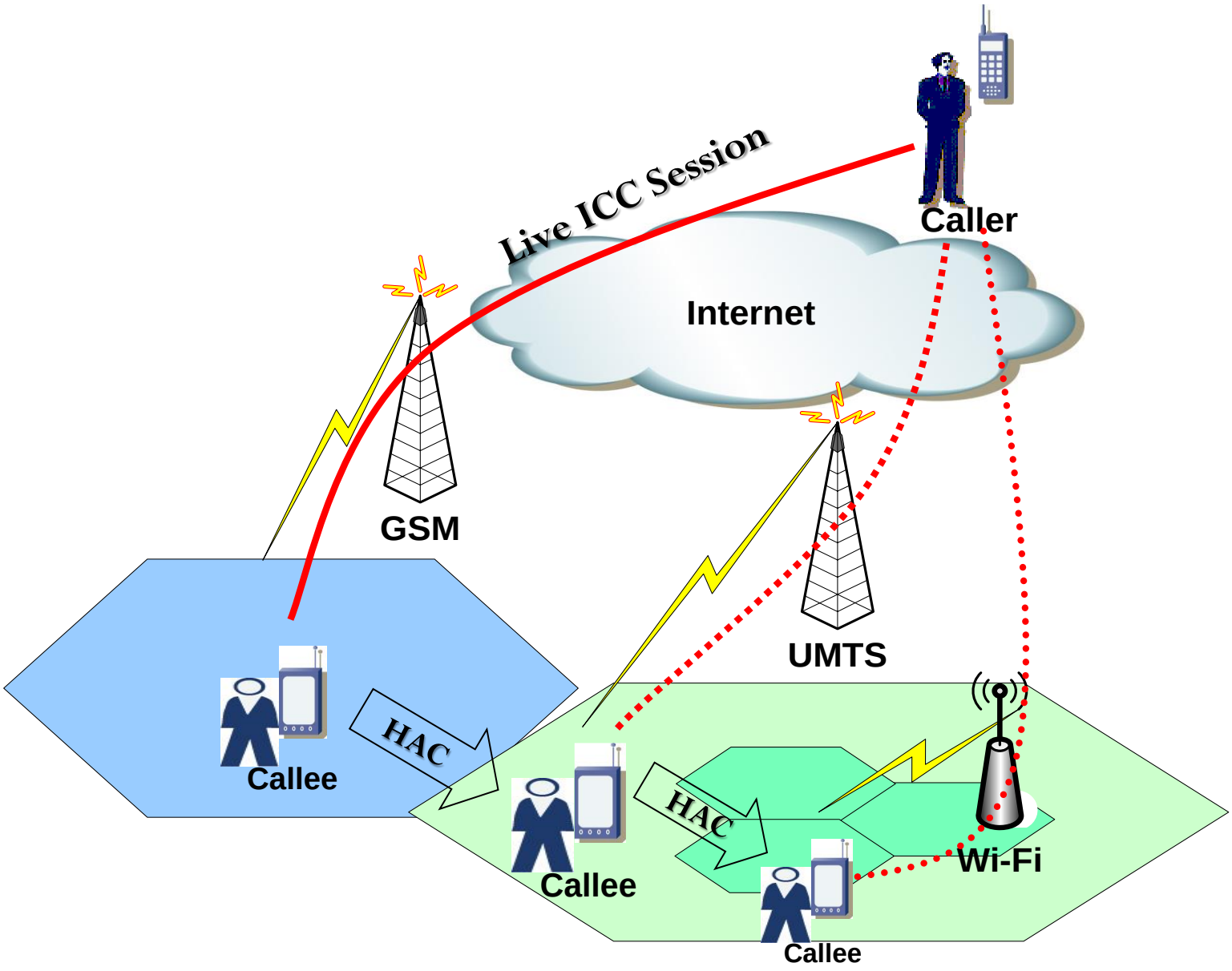
CBM-ICC: Architecture's Interfaces



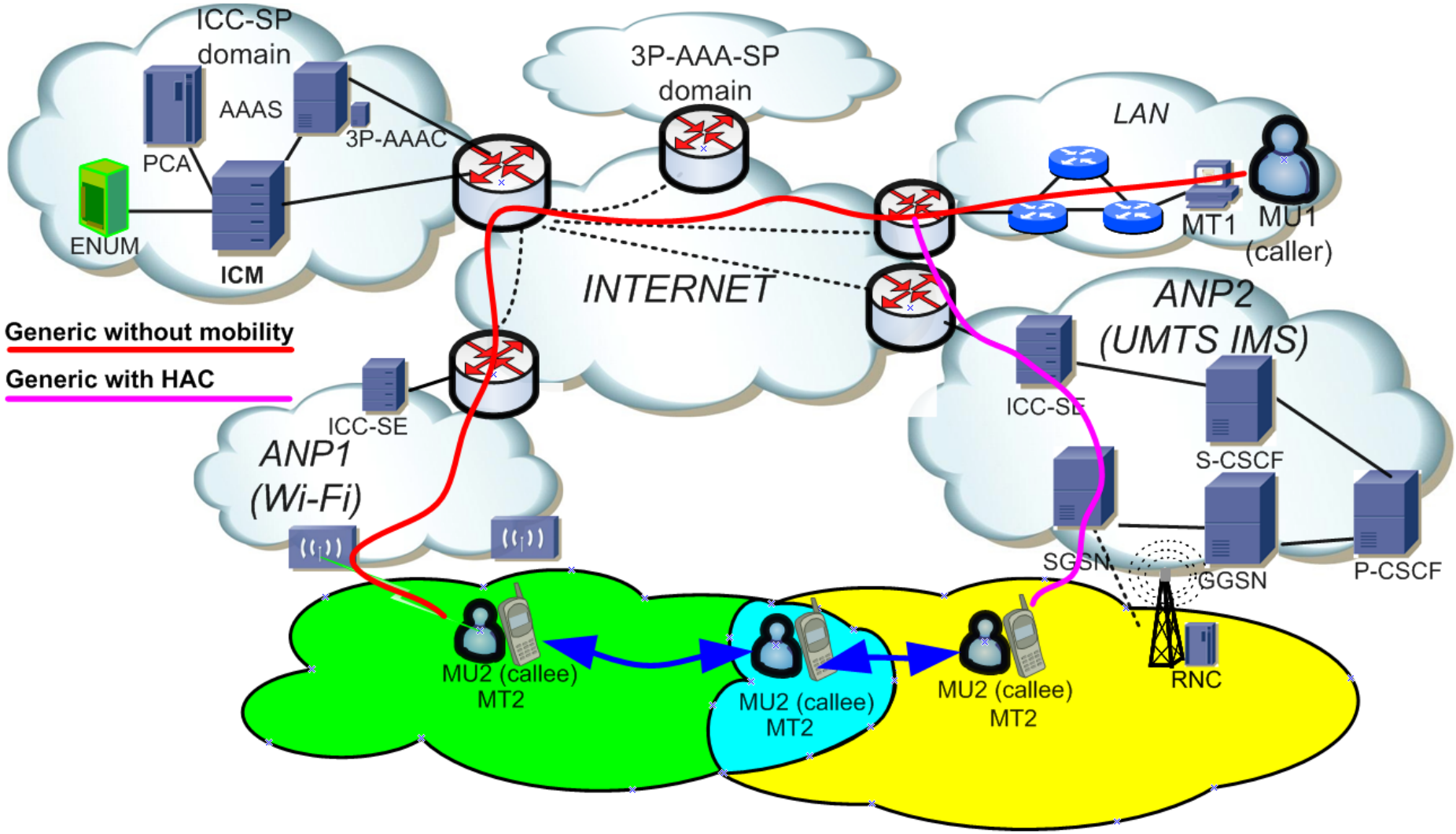
CBM-ICC: Architecture's Interfaces (cont.)

Ifs	Entities	Description	Protocol
Ia Ia*	MT↔AAAS 3P-AAAC↔3P-AAA-SP	Exchange of 3P-AAA messages	3P-AAA extension of Diameter
Ic	MT↔ PCA	Interaction between PCA and MT	CPL/VoXML
Id	PCA ↔ DB ICM ↔ DB	Enquire/store data in the database	LDAP/SQL
It	MT ↔ ICC-SE	Interaction between MT and ICC-SE	SIP/SDP//H.323/SS7
In	ICM ↔ ICC-SE	Interaction between ICM and ICC-SE	SIP/SDP
Ie	ENUM ↔ ICC-SE ENUM ↔ ICM	Convert E.164 number to ICC support format	ENUM/DNS

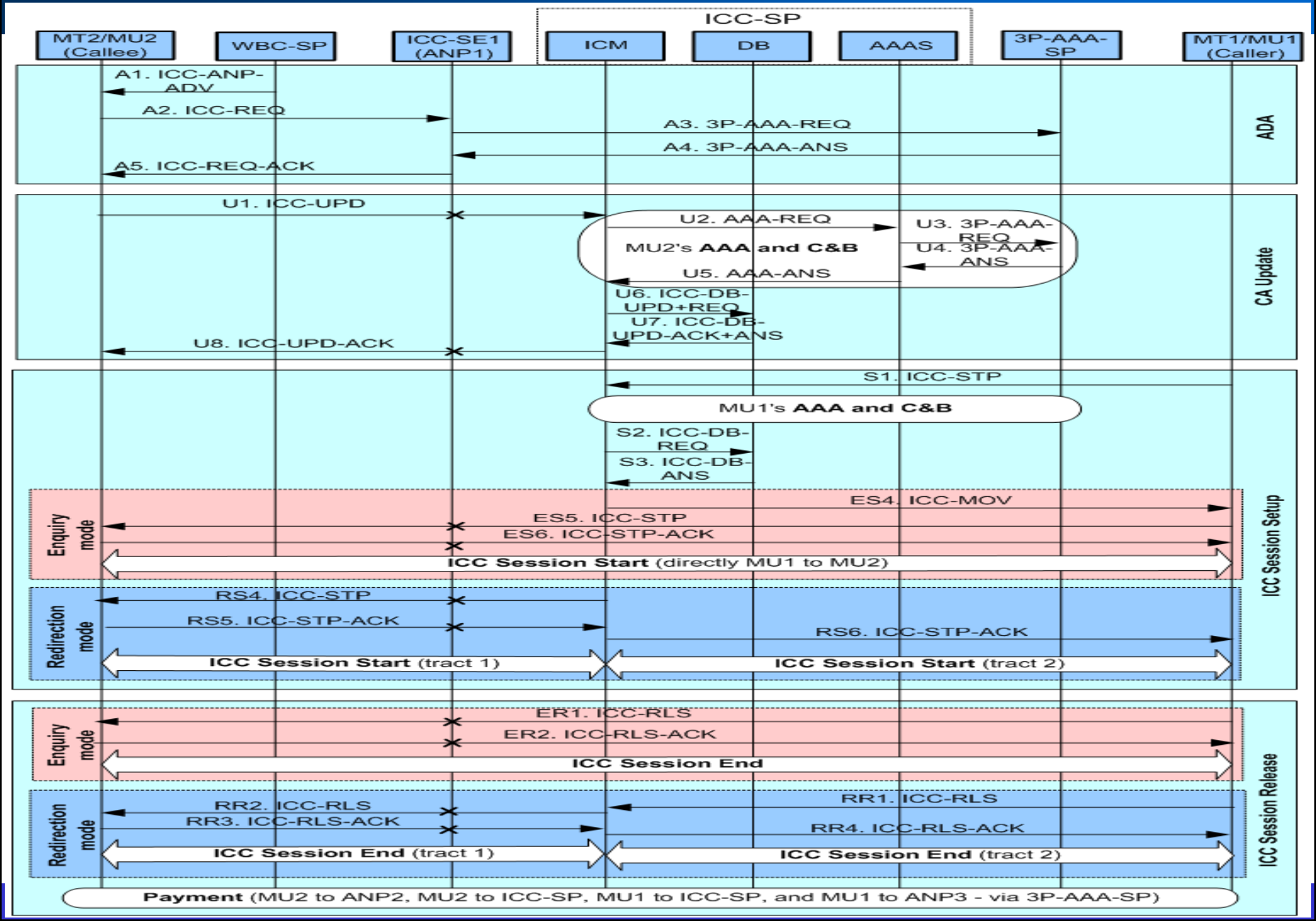
CBM-ICC: Hot Access network Change (HAC)



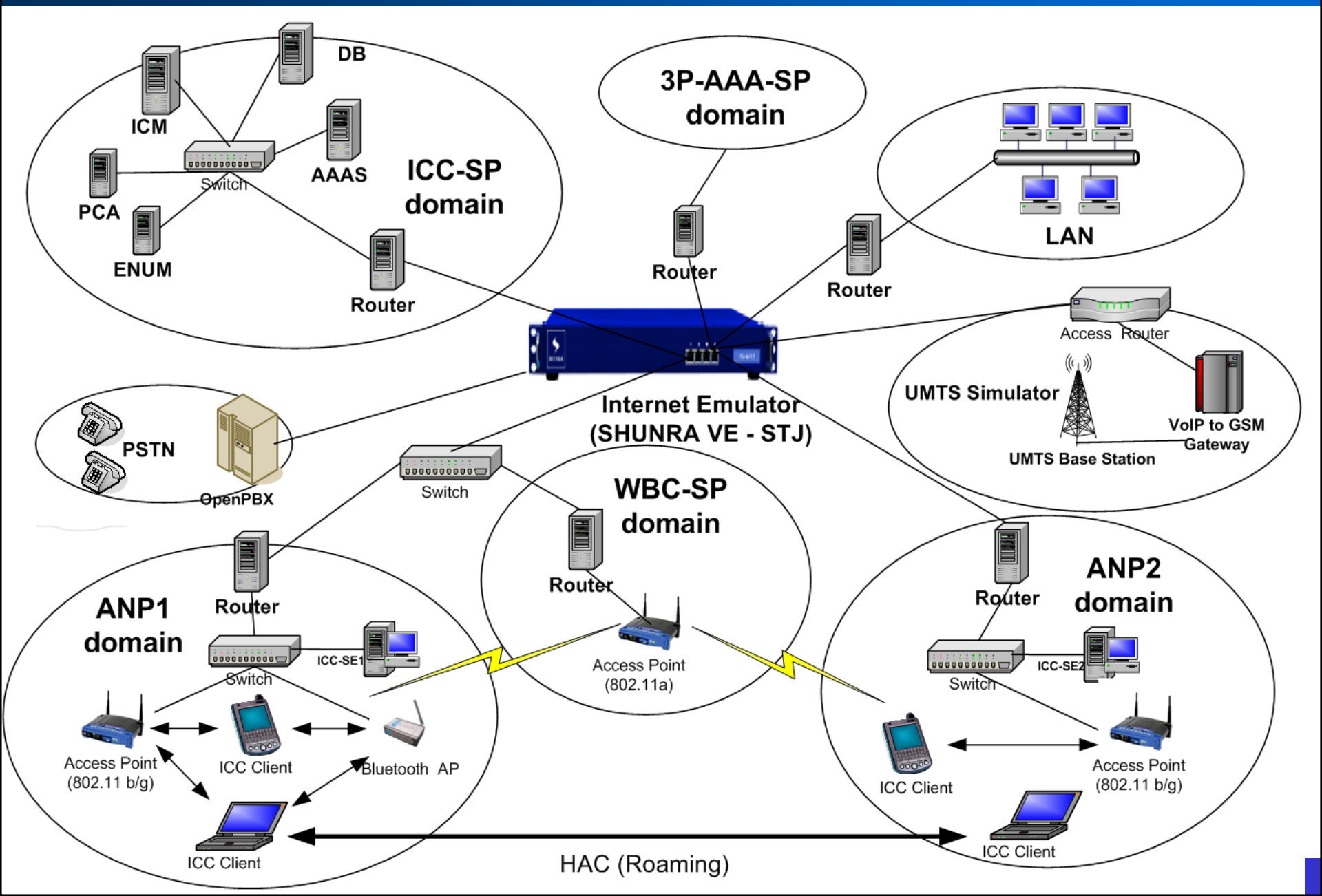
CBM-ICC: Signaling Scenarios



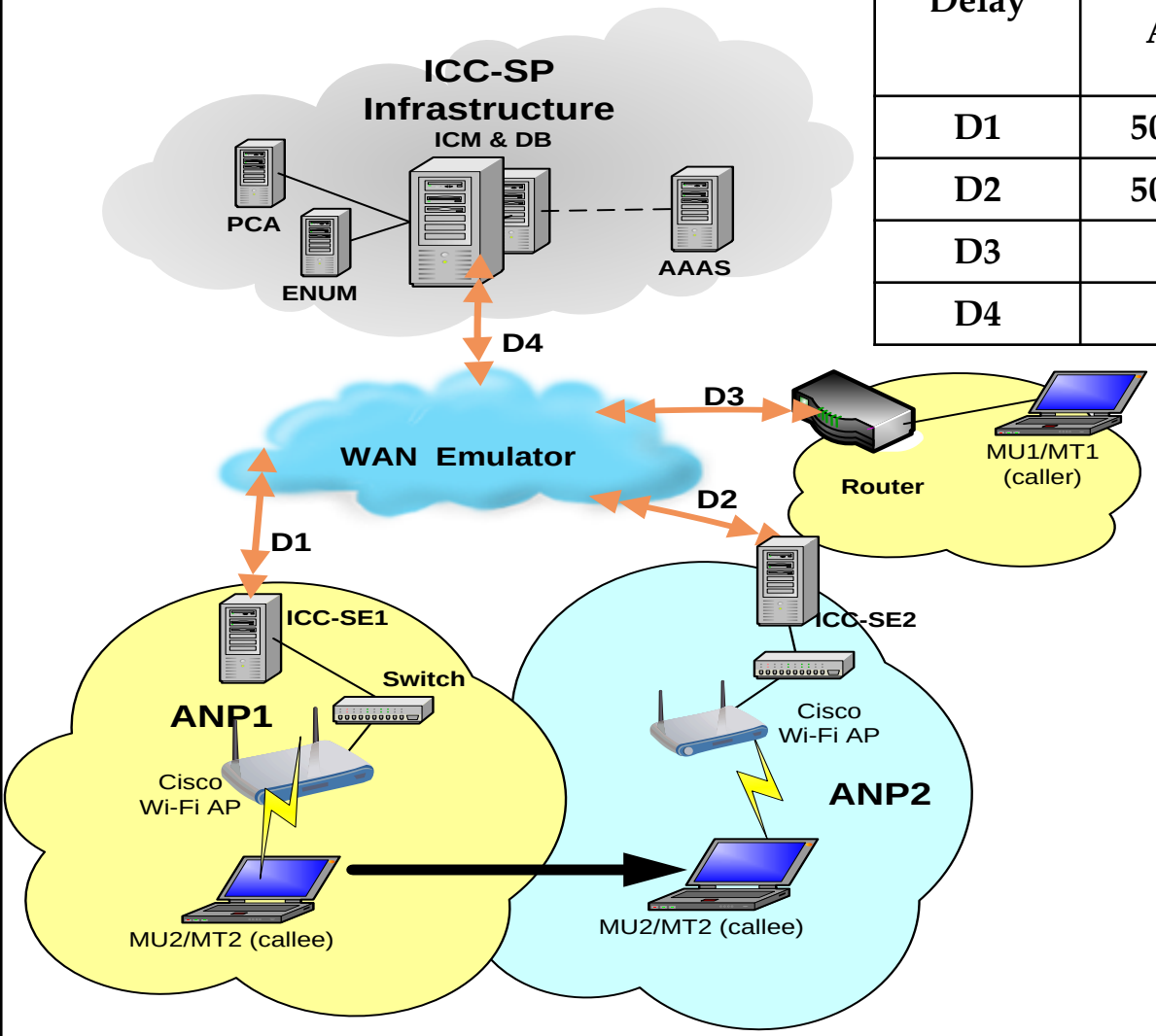
CBM-ICC: Generic Signaling Flow



CBM-ICC: Proof-of-Concept Testbed



CBM-ICC: Testbed Schematics



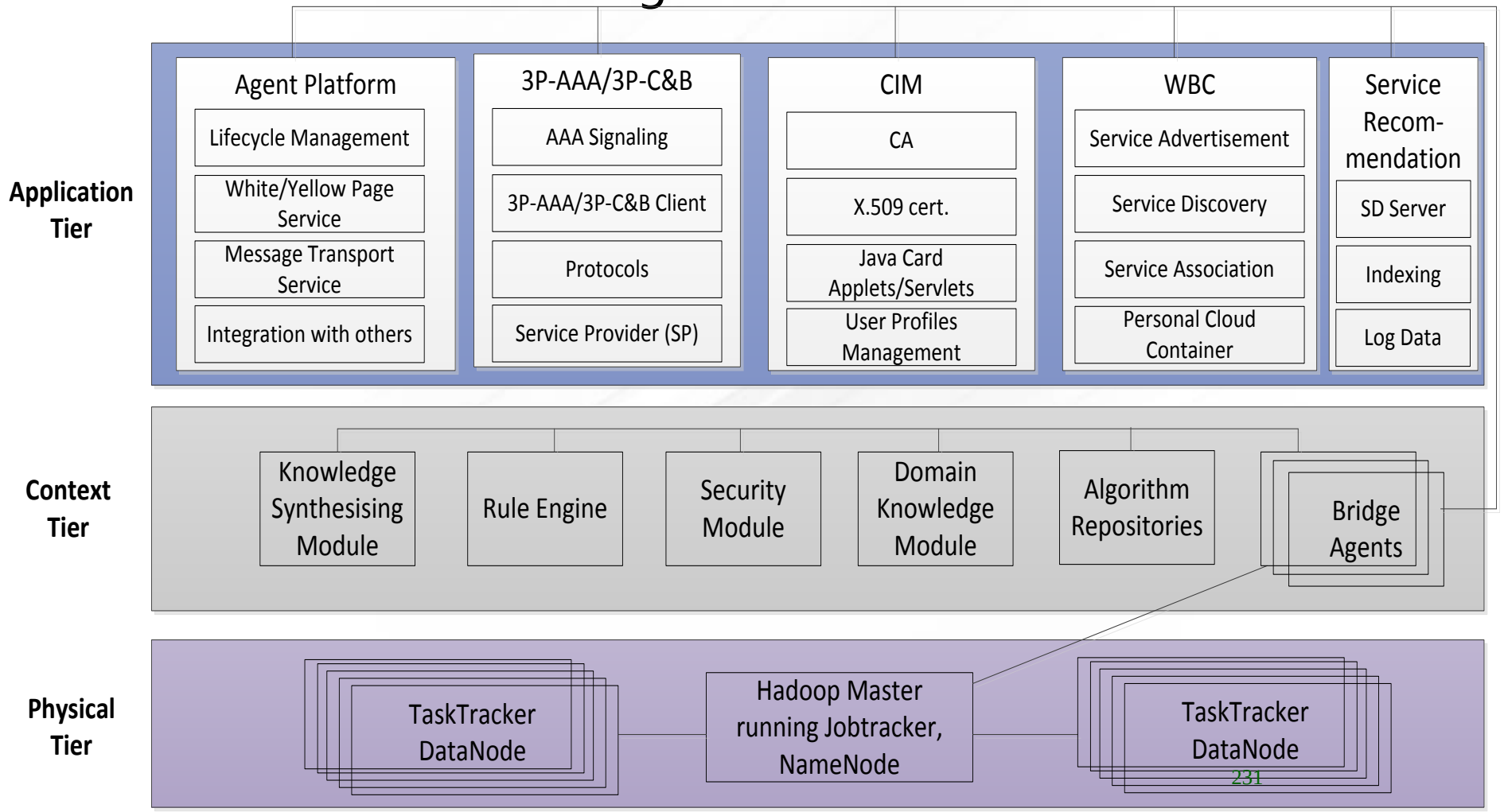
Link Delay	Delay (normal distribution)		Packet Loss
	Average*	Standard Deviation	
D1	50ms/70ms	10ms	0-5%
D2	50ms/70ms		
D3	50ms		
D4	20ms		

* R. Chakravorty, P. Vidales, K. Subramanian, I. Pratt, and J. Crowcroft, "Performance issues with vertical handovers - Experiences from GPRS cellular and WLAN hot-spots integration," Proceedings of the second IEEE Annual Conference on Pervasive Computing and Communications, pp. 155–164 372, 2004.

* A. Mercier, P. Minet, L. George, and G. Mercier, "Adequacy between multimedia application requirements and wireless protocols features," IEEE Wireless Communications, vol. 9, no. 6, pp. 26–34, 2002.

UCWW: Software Architecture

Given that the UCWW components interoperate with each other in a distributed fashion, a **3-tier cloud-based architectural model** design is followed.



CBM/UCWW: Wrap-up Conclusions 1/2

Main beneficiaries

- **Consumers** - huge increase in
  - Freedom of choice & mobility
    - in obtaining & managing wireless services
  - Full number portability
  - User-driven Always Best Connected & best Served (ABC&S)
- **All Wireless Business Stakeholders**
  - Manufacturers, Mobile Service Providers, Application Developers, ANPs, …
  - New wireless business entrepreneurs

CBM/UCWW: Wrap-up Conclusions 2/2

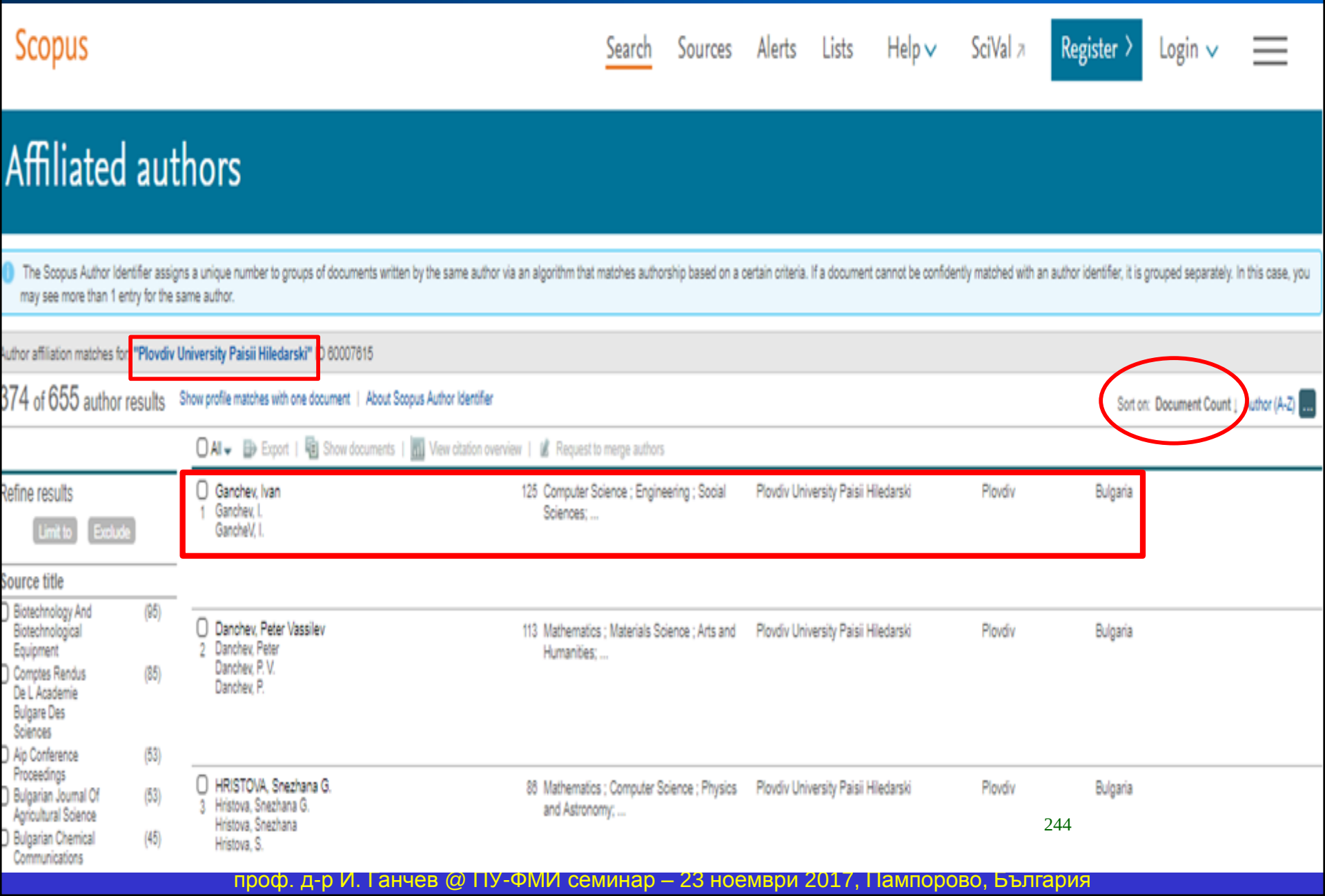
Benefits include

- **More open wireless communications market**
  - 'Level playing field' for new network-provider entrants
- **Immensely increased business opportunities** for
  - Wireless access-network-providers
  - Mobile phone manufacturers
  - Others
- **Removal of roaming charges**
- **Stimulation of**
  - Many new telecommunication services & drivers for ABC&S
  - New wireless communications businesses
    - 3P-AAA-SPs; WBC-SPs; ICC-SPs: +++
  - New niche and specialized wireless-access-network opportunities
- Ingredients for a potential **commercial solution** for **Ad Hoc networking**

More Info 1/3

- **I. Ganchev**, Z. Ji, M. O'Droma, L. Zhao. 2017. “Smart Recommendation of Mobile Services to Consumers”. *IEEE Transactions on Consumer Electronics*, November, Pp. x1-x10. **IF_{2016}=1,694**
- H. Zhang, **I. Ganchev**, N.S. Nikolov, Z. Ji, M. O’Droma. "A Hybrid Service Recommendation Prototype Adapted for the UCWW: A Smart City Orientation". *Wireless Communications and Mobile Computing*, Wiley/Hindawi. Vol. 2017, October 2017, Pp. x1-x11. Article ID: 6783240. **IF_{2016}=1,899**
- Z. Ji, **I. Ganchev**, M. O’Droma, X. Zhang. “A Realization of Broadcast Cognitive Pilot Channels Piggybacked on T-DMB”. *Wiley Transactions on Emerging Telecommunications Technologies*, Vol. 24, Issue 7-8, Pp. 709-723. Nov.-Dec. 2013. **IF=0,783**
- Z. Ji, **I. Ganchev**, M. O'Droma. “An iWBC Consumer Application for 'Always Best Connected and Best Served': Design and Implementation”. *IEEE Transactions on Consumer Electronics*, Vol. 57, No. 2, Pp. 462-470. May 2011. **IF=0,941**
- M. O’Droma, **I. Ganchev**, “The Creation of a Ubiquitous Consumer Wireless World through Strategic ITU-T Standardization,” *IEEE Communications Magazine*. Vol. 48, No. 10, Pp. 158-165, 2010. **IF=2,837**
- Z. Ji, **I. Ganchev**, M. O’Droma. “`WBC over DVB-H` Testbed Design, Development and Results”. *EURASIP Journal on Wireless Communications and Networking*, Vol. 2010, Article ID 769683, 18 pp., 2010. **IF=0,815**
- **I. Ganchev**, M. O'Droma, N. Wang. “Consumer-Oriented Incoming Call Connection Service for UCWW”. *Springer Wireless Personal Communications*, Vol. 50, No. 1, Pp. 115-131. 2009. **IF=0,418**
- Z. Ji, **I. Ganchev**, M. O’Droma. 2009. “Performance Evaluation of 'WBC over DVB-H' System”. *IEEE Transactions on Consumer Electronics*, Vol. 55, No. 2, May, Pp. 754-762. **IF=0,942**
- M. O’Droma, **I. Ganchev**, “Toward a Ubiquitous Consumer Wireless World,” *IEEE Wireless Communications*, Vol. 14, No. 1, Pp. 52-63, 2007. **IF=2,000**

More Info 2/3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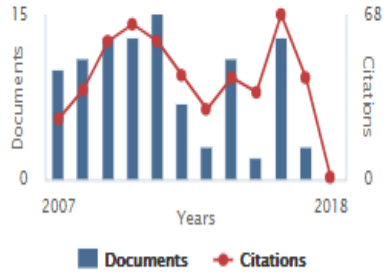

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