3G-
Universal
Mobile Telecommunication System
(UMTS)

4G systems and Services

Nancy Alonistioti
nancy@di.uoa.gr

Πλαίσιο Μαθήματος

- **Ραγδαία εξέλιξη των δικτύων και υπηρεσιών κινητών επικοινωνιών**
- **UMTS, LTE, FI**
- **Αναδιαμορφώσιμα δίκτυα ΚΕ – γνωσιακά δίκτυα (reconfigurable – cognitive networks)**
- **Υποστήριξη προηγμένων υπηρεσίων:**
  - σε πολλούς τομείς δραστηριοτήτων του χρήστη
  - αυξημένη πολυπλοκότητα
  - απαιτήσεις συνδεσιμότητας και πρόσβασης σε ετερογενή δίκτυα
  - διαχείριση πολυμεσικού περιεχομένου
- **Autonomic communications – αυτόνομες επικοινωνίες**
- **Διαχείριση πληροφορίας πλαισίου περιβάλλοντος**
- **Επέκταση των εμπλεκόμενων επιχειρηματικών φορέων και των ρόλων τους**

ΕΡΓΑΣΙΕΣ

1. Αναλύστε τα βασικά χαρακτηριστικά που προδιαγράφονται για το LTE ως μετεξέλιξη του UMTS
2. Ποια τα βασικά χαρακτηριστικά των επικοινωνιών 4G, ποιές οι βασικές τεχνολογίες και οι δυνατότητες των συστημάτων
3. Αναλύστε τα βασικά χαρακτηριστικά των αναδιαμορφώσιμων συστημάτων κινητών επικοινωνιών (reconfigurable system, Software defined radio)
4. Αναλύστε τις βασικές εννοιες και δυνατότητες των αυτόνομων επικοινωνιών (autonomic communications)
5. Προσαρμοστικές υπηρεσίες κινητών επικοινωνιών (Adaptable mServices)
6. Cognitive Radio – Γνωσιακά συστήματα επικοινωνιών
7. Χαρακτηριστικά και υπηρεσίες του μελλοντικού Ιντερνετ (Future Internet)

Τι είναι το UMTS

Universal Mobile Telecommunications System

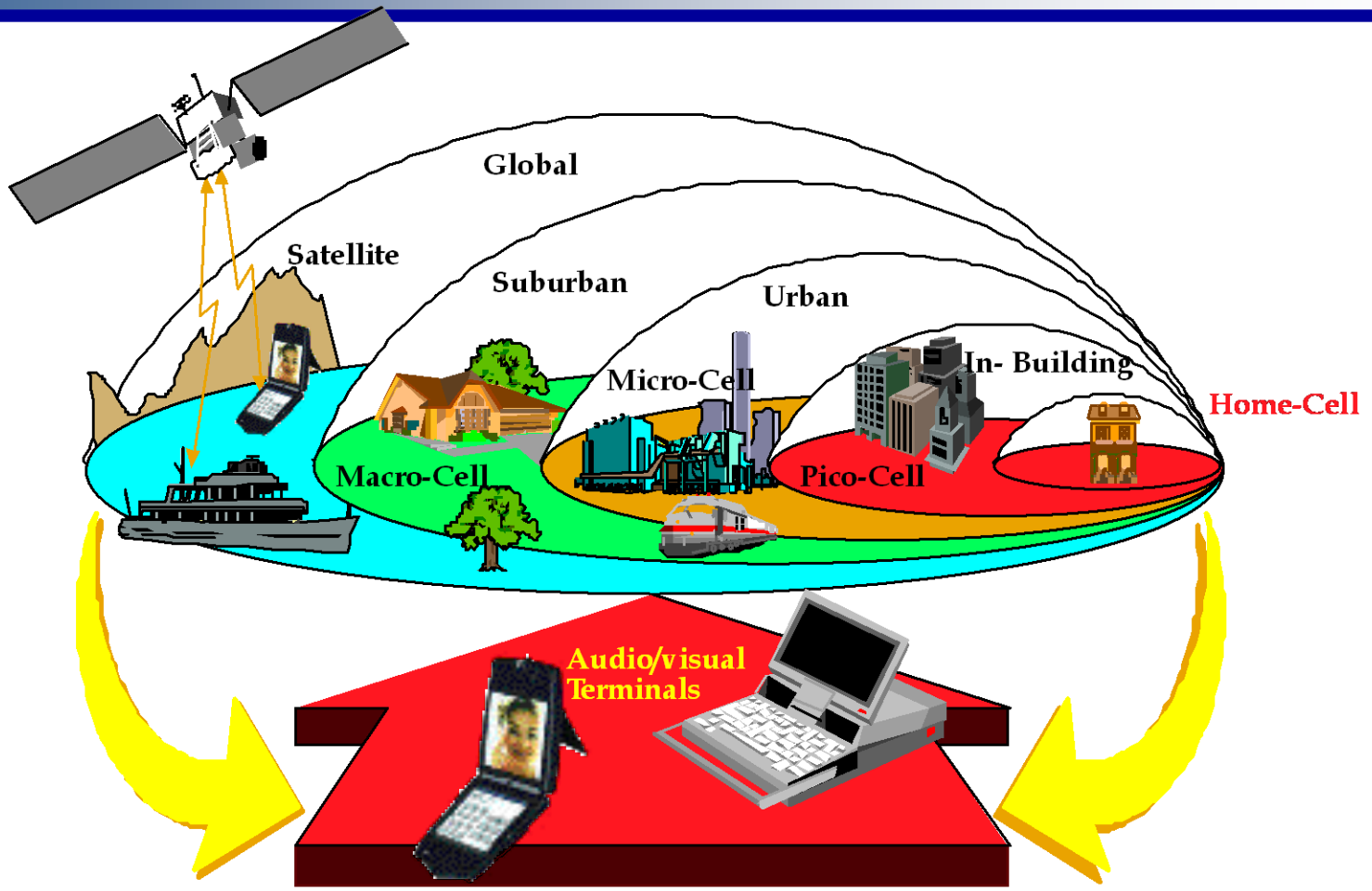
Σύστημα κινητών επικοινωνιών τρίτης γενιάς

Σκοπός:

Η επαύξηση των δυνατοτήτων των σημερινών ασύρματων, κινητών και δορυφορικών τεχνολογιών με τη χρήση ενός πρωτοποριακού συστήματος ραδιο-τεχνολογίας και ενός εξελιγμένου δικτύου κορμού. Δίνει τη δυνατότητα επικοινωνίας μέσω πολυμεσικών εφαρμογών σε υψηλούς ρυθμούς μετάδοσης.

Νέες προοπτικές στην αγορά της κινητής τηλεφωνίας

Τι είναι το UMTS



Inter-Network Roaming

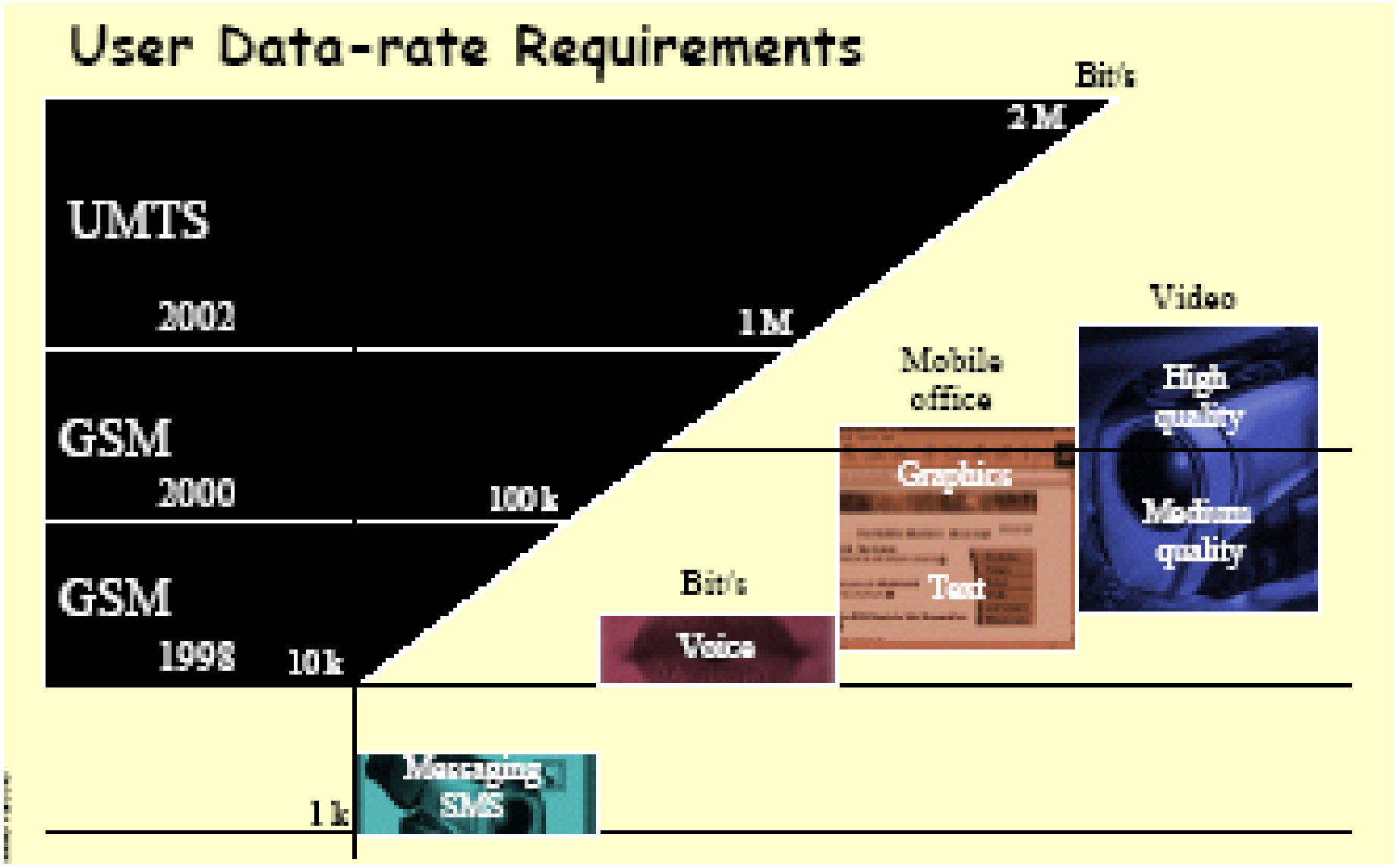
Seamless end-to-end Service

3G-4G services

UMTS1

UMTS

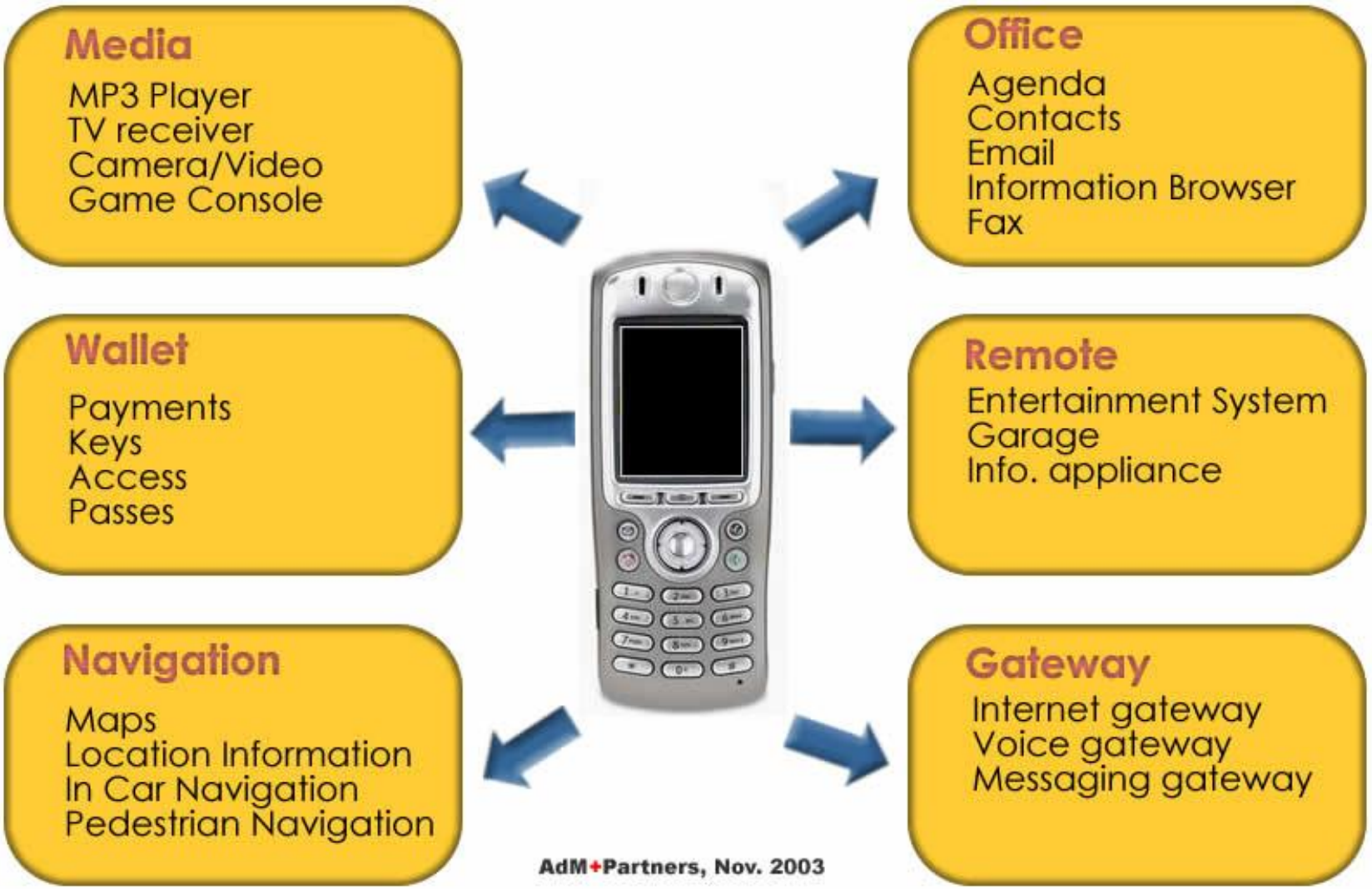
Ρυθμοί μετάδοσης



Υπηρεσίες

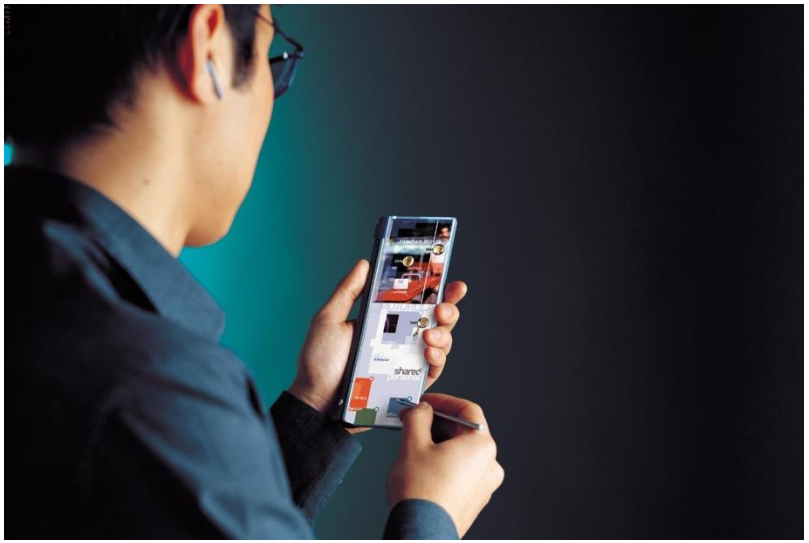

Service Evolution
The power of Mobility
Call Handling
Messaging
Navigation services
Information Services
Games
E-commerce
Transport
Data Base Access

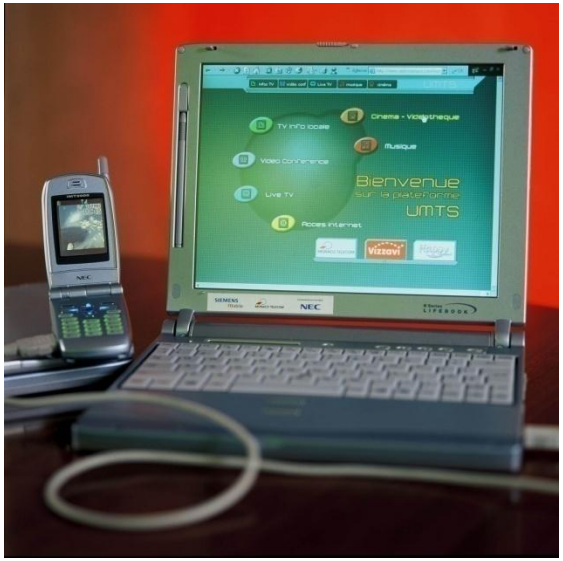
Υπηρεσίες


Media
MP3 Player
TV receiver
Camera/Video
Game Console
Office
Agenda
Contacts
Email
Information Browser
Fax
Wallet
Payments
Keys
Access
Passes
Remote
Entertainment System
Garage
Info. appliance
Navigation
Maps
Location Information
In Car Navigation
Pedestrian Navigation
Gateway
Internet gateway
Voice gateway
Messaging gateway
AdM+Partners, Nov. 2003

Τερματικά 3ης γενιάς

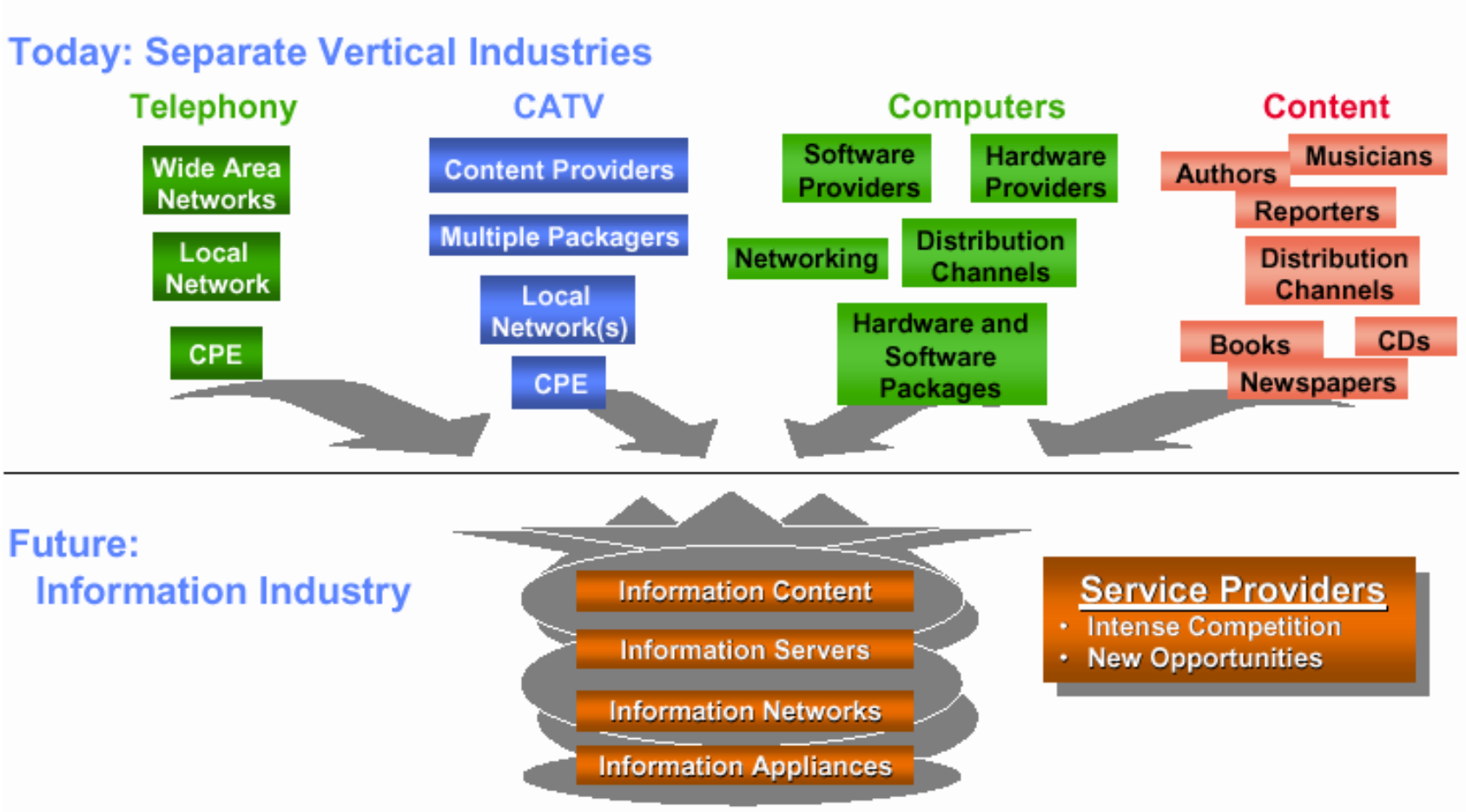
Motorola 3G Concept Model – The Video Phone



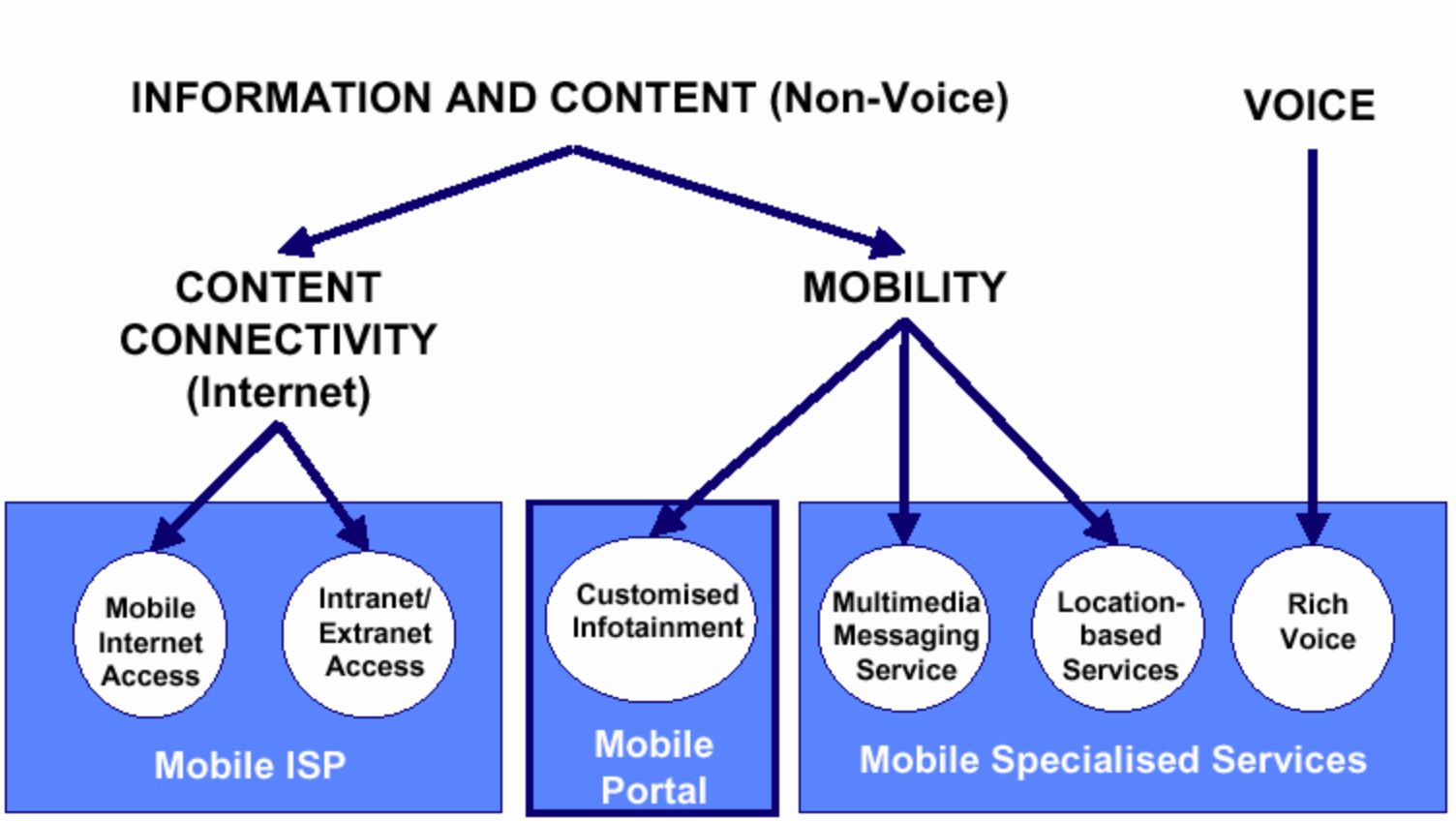


Mobile services

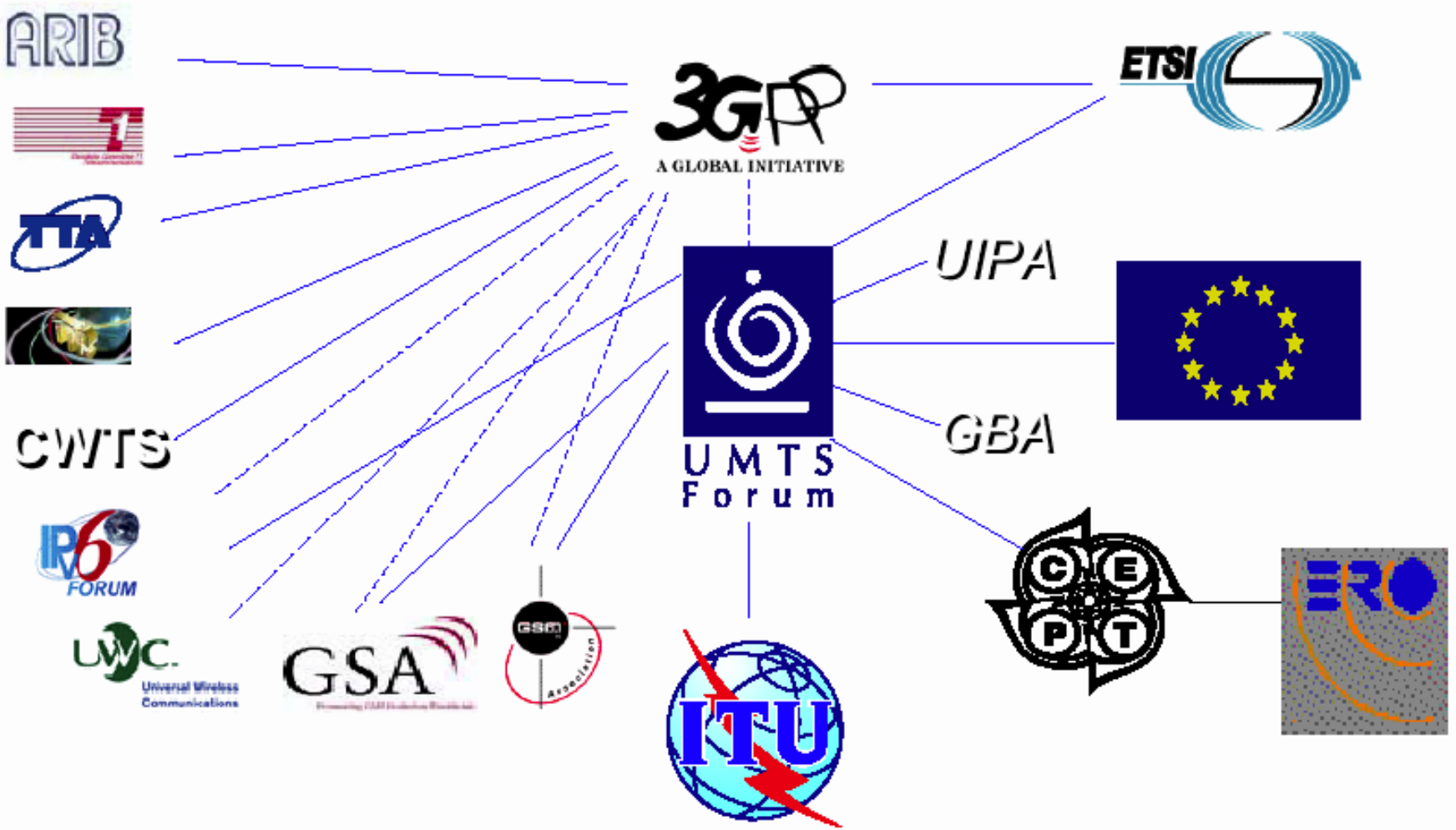
Αλλαγές στη βιομηχανία επικοινωνιών



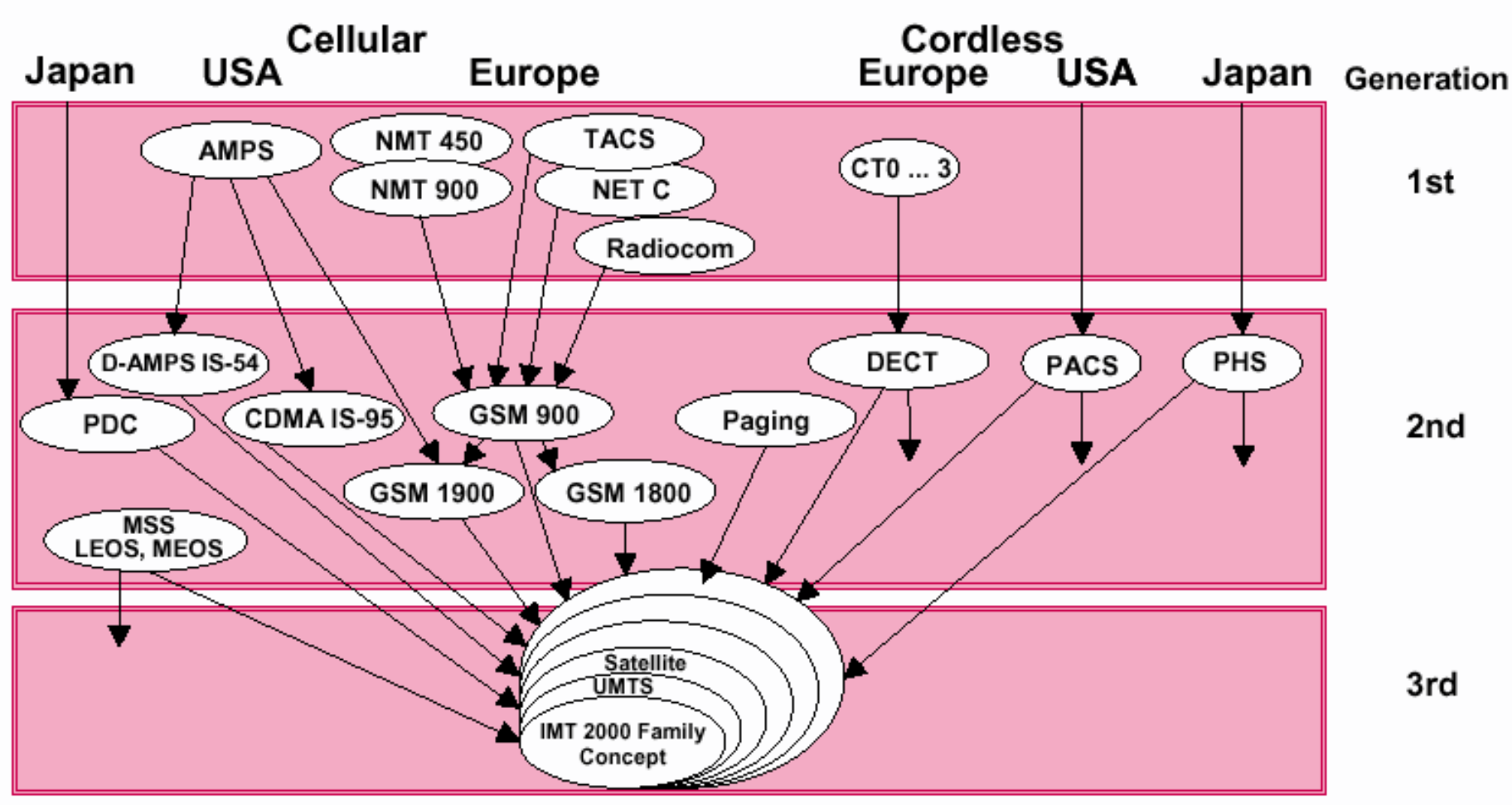
Εισαγωγή νέων μοντέλων



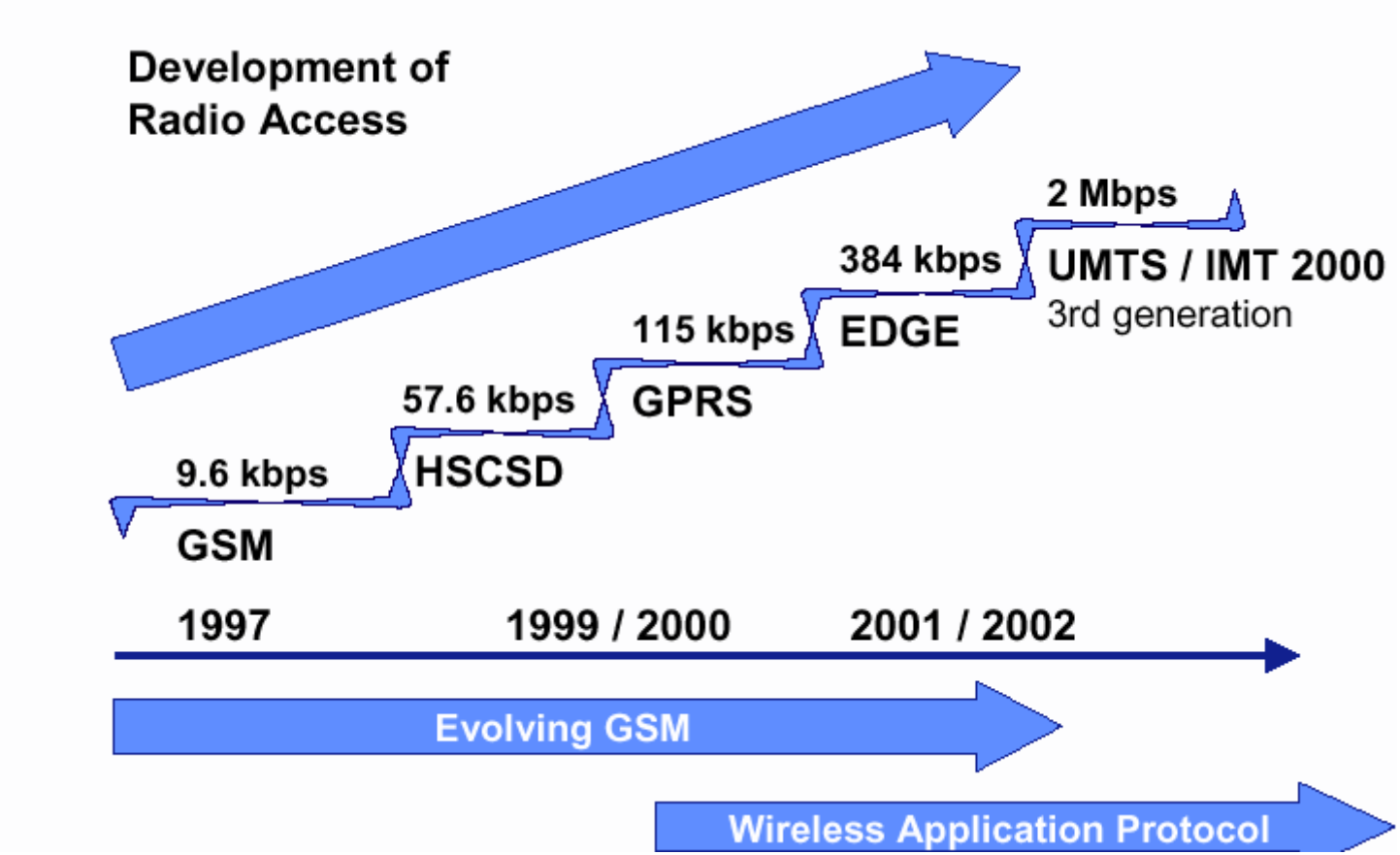
Διαδικασίες προτυποποίησης συστημάτων



Σύγκλιση ασύρματων και κυψελωτών συστημάτων



Εξελίξεις της τεχνολογίας



Διαφορές των συστημάτων τρίτης γενιάς από τα συστήματα δεύτερης γενιάς

Μεταφορά από την κλασσική υπηρεσία τηλεφωνίας σε ένα περιβάλλον διαδραστικό και πολυμεσικό

Υπηρεσίες	Μετάδοση φωνής, μηνύματα	πολυμεσικές εφαρμογές
Ρυθμοί μετάδοσης	9.6 - 14.4 Kbps	2Mbps
Μέθοδος μεταγωγής	κυκλωματο-μεταγωγή	ασυνδεσμικό περιβάλλον
Χρέωση	Ανάλογη του χρόνου/τοποθεσία	Πολλαπλές μέθοδοι

Mobile E-business

nancy@di.uoa.gr

Πλαίσιο χρήσης κινητών επικοινωνιών στο επιχειρηματικό περιβάλλον

- e/mBusiness
- mCommerce
- Mobile Data Systems
- Mobile Workers
- Strategic Planning
- Wireless Communications Services
- Wireless LAN
- Wireless Security

Προβλέψεις για την ανάπτυξη του ηλεκτρονικού εμπορίου

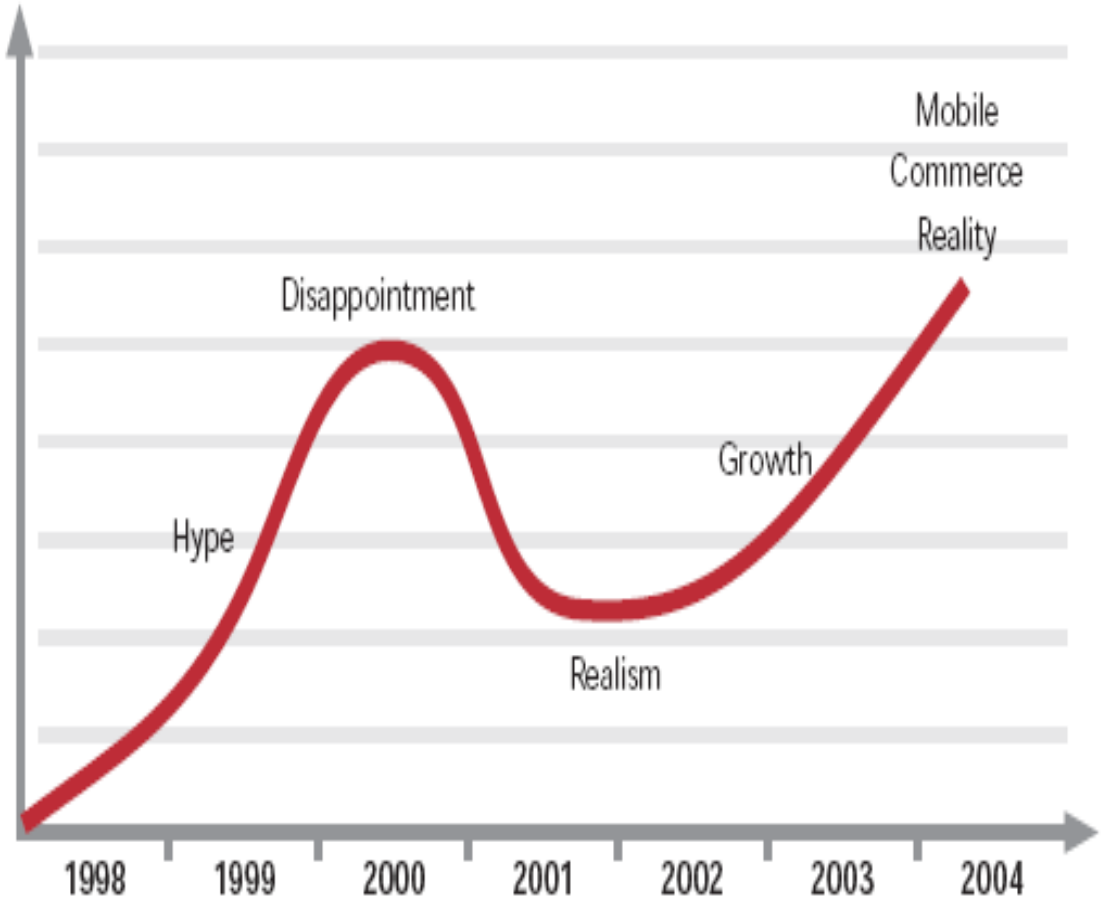


Figure
mCommerce Hype Curve. Redrawn from Durlacher Research Ltd., 1999.

Εφαρμογές στην επιχειρηματικότητα

- remote customer care
- call management
- information services
- electronic commerce
- transactions and banking services
- online address book and directory services
- mobile adds
- remote business transactions, confirmation, and administration
- innovative marketing and selling to customers on the move as well as a deeper, more personalized customer relationship, directly resulting in an improved bottom line and greater customer satisfaction
- alert agent and manager regarding service emergencies
- customer can inquire into the status of service requests including statistics of new service calls, calls in process, current status and closed calls
- collaborative work

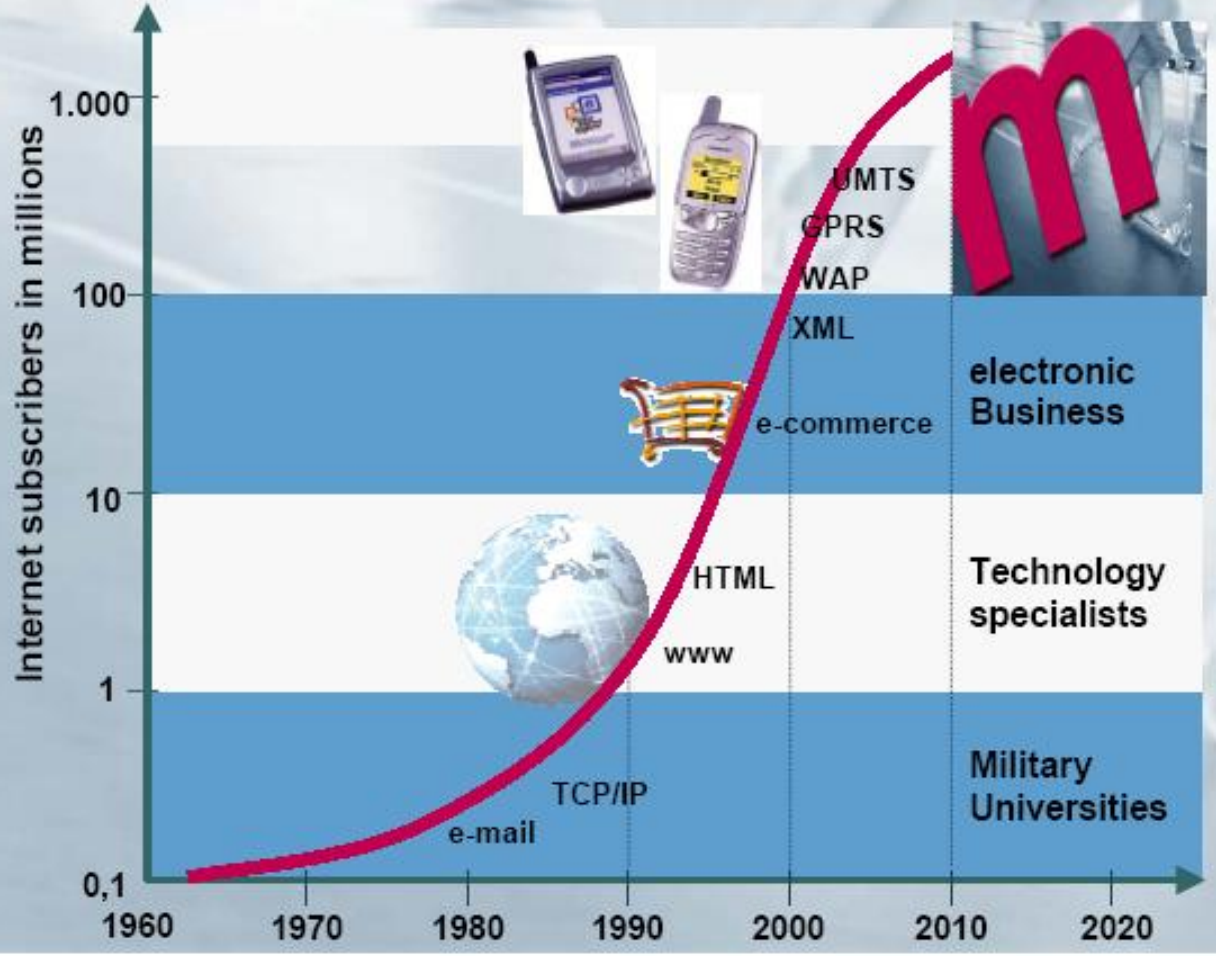
Industry Applications

- mBanking
- mPayment
- mTrading
- mAirline Tickets
- mPublic Transit
- mHotels Booking
- mCity/Country Guides
- mTracking & Dispatch
- mTicket
- mRestaurant Search
- mGuide
- mTV Guide
- mYellow Pages

mBusiness

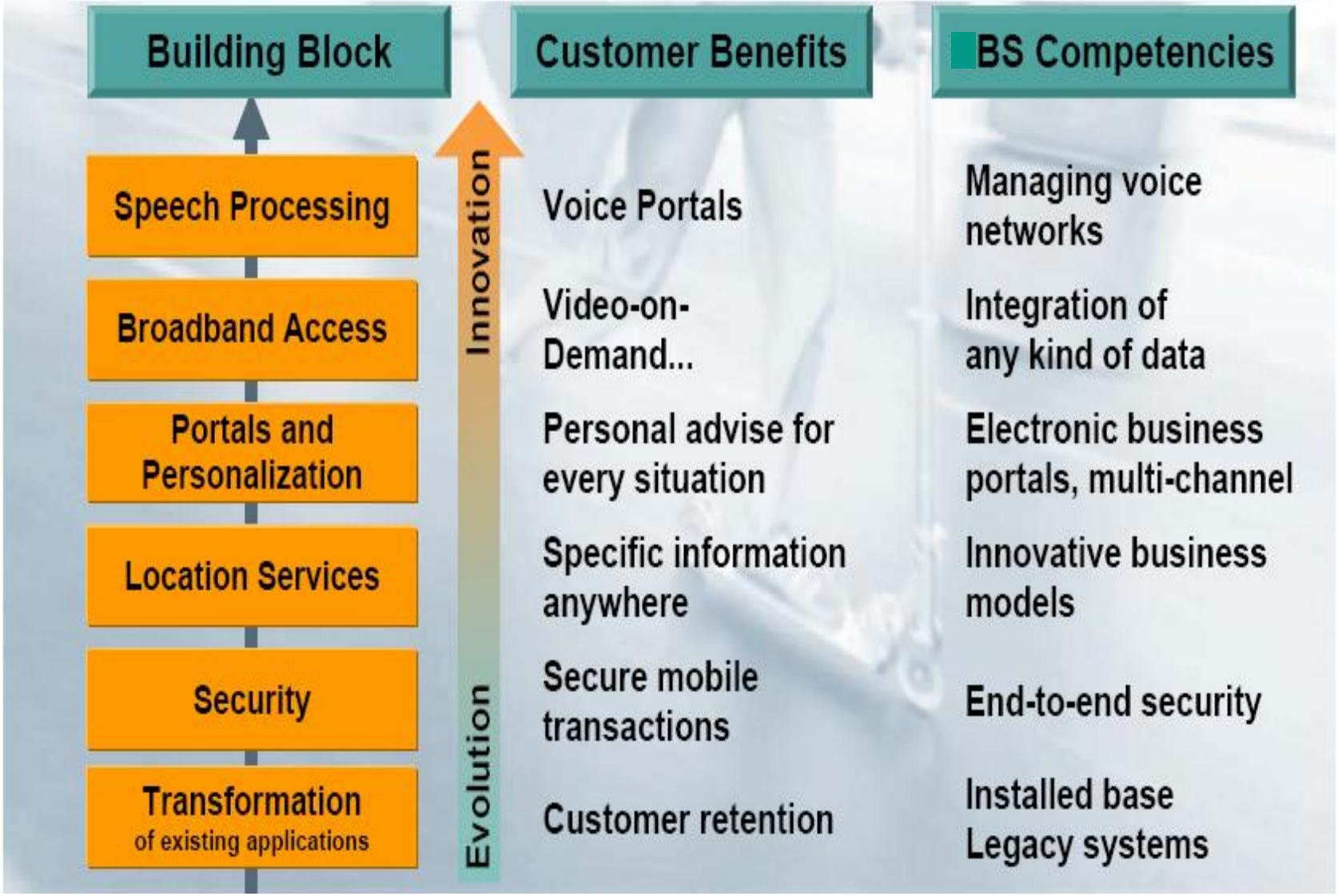
- mBusiness σημαίνει τη χρήση του κινητού τηεφώνου/τερματικού για επιχειρηματικές συναλλαγές
- mBusiness means using a mobile device to make business practice easier, more efficient or more profitable. If you use your mobile phone for work you're probably already doing 'mBusiness' every day!
- Mobile technology means that you can now work more efficiently when you're out of the office. You can:
  - carry out tasks remotely – those that would normally require to be done on a computer in the office;
  - communicate with people at remote locations; and
  - work with data that is held at your office – even when you are in a different location.

mobile business -
The next step of the Internet revolution

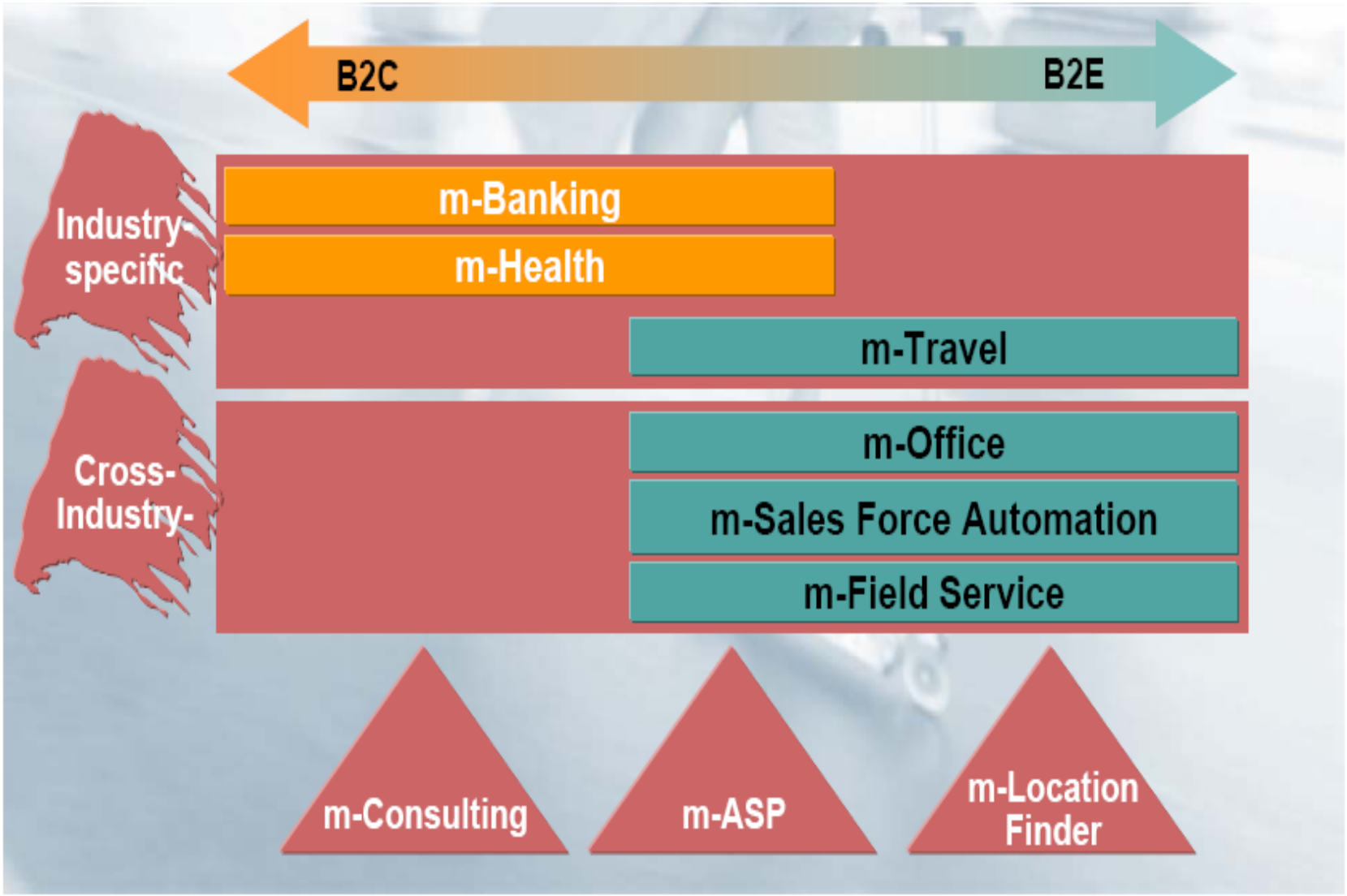


- mobile business makes the Internet the major marketplace
- mobile business stimulates totally new business models
- two waves in mobile business

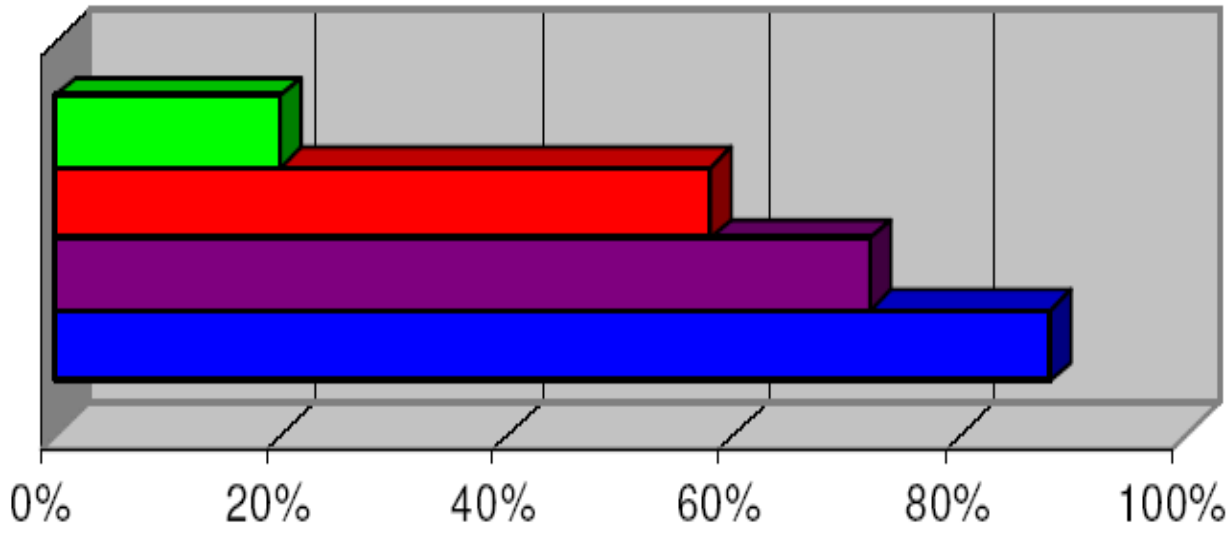
Building blocks to leverage Business Services competencies in order to help enterprises move into mobile business



Mobile business Portfolio for Enterprises

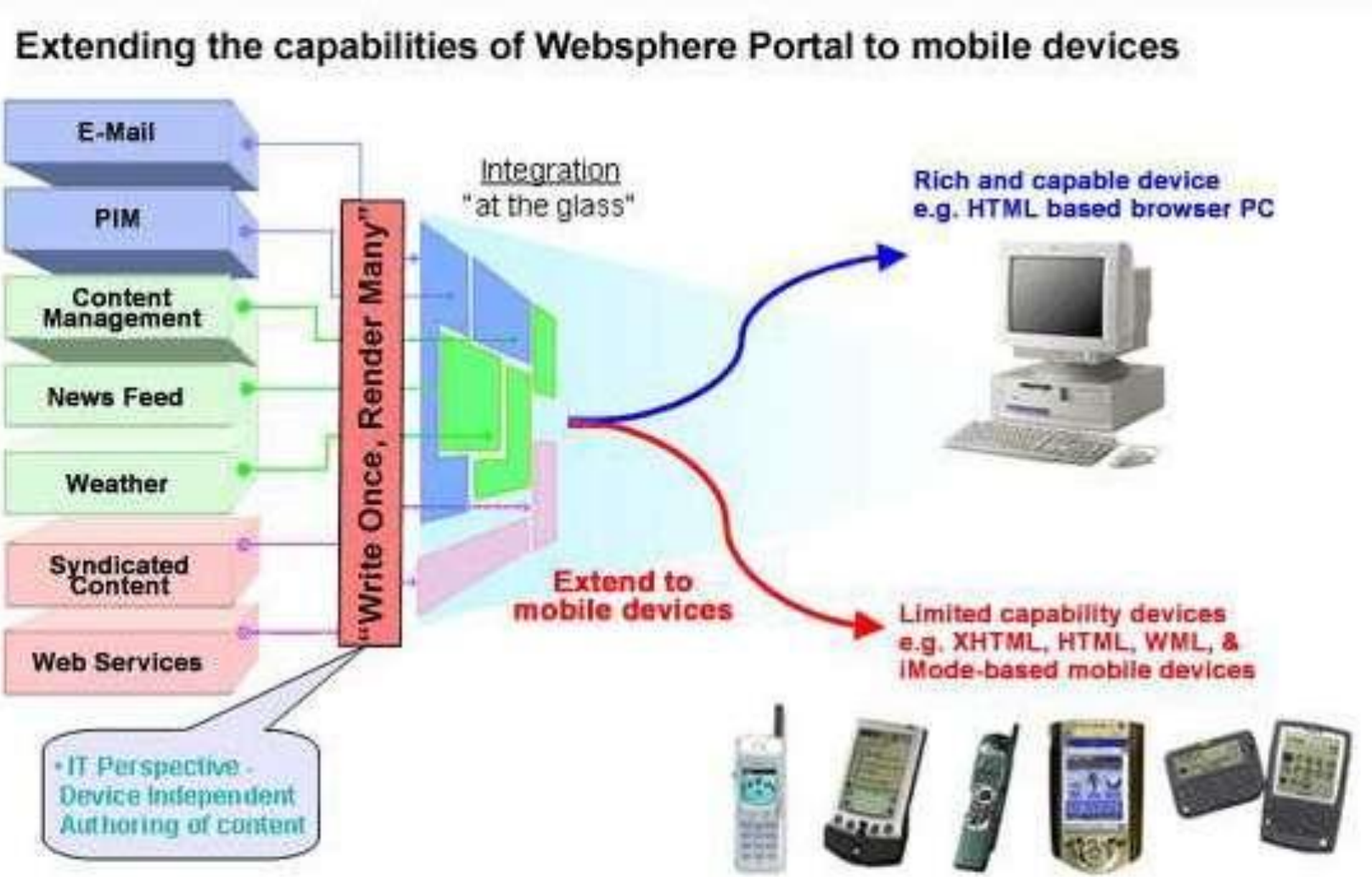


What eBanking is used for



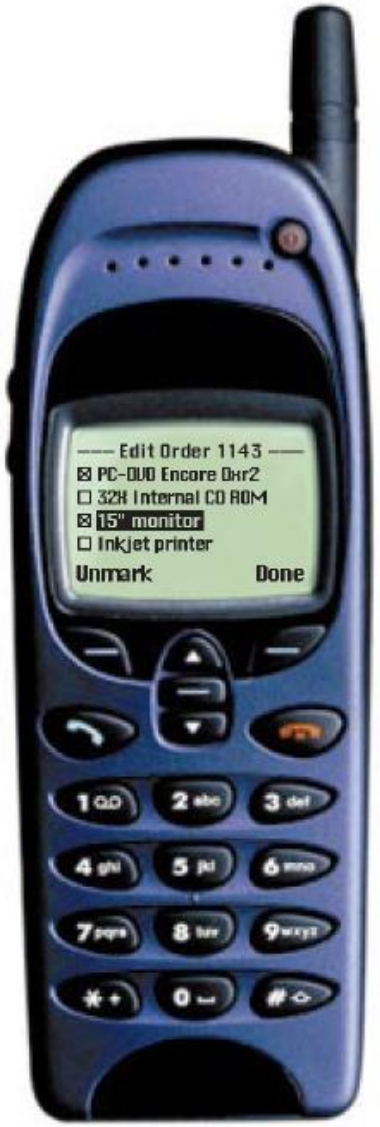
- Online application for a credit card, loan, savings account, mortgage or insurance
- Bill payment
- Fund transfers
- Balance and transaction checking

Mobile E-business applications



Ηλεκτρονικές πωλήσεις

- Predefined order templates
- Order tracking and status checking via the mobile phone



Mobile worker

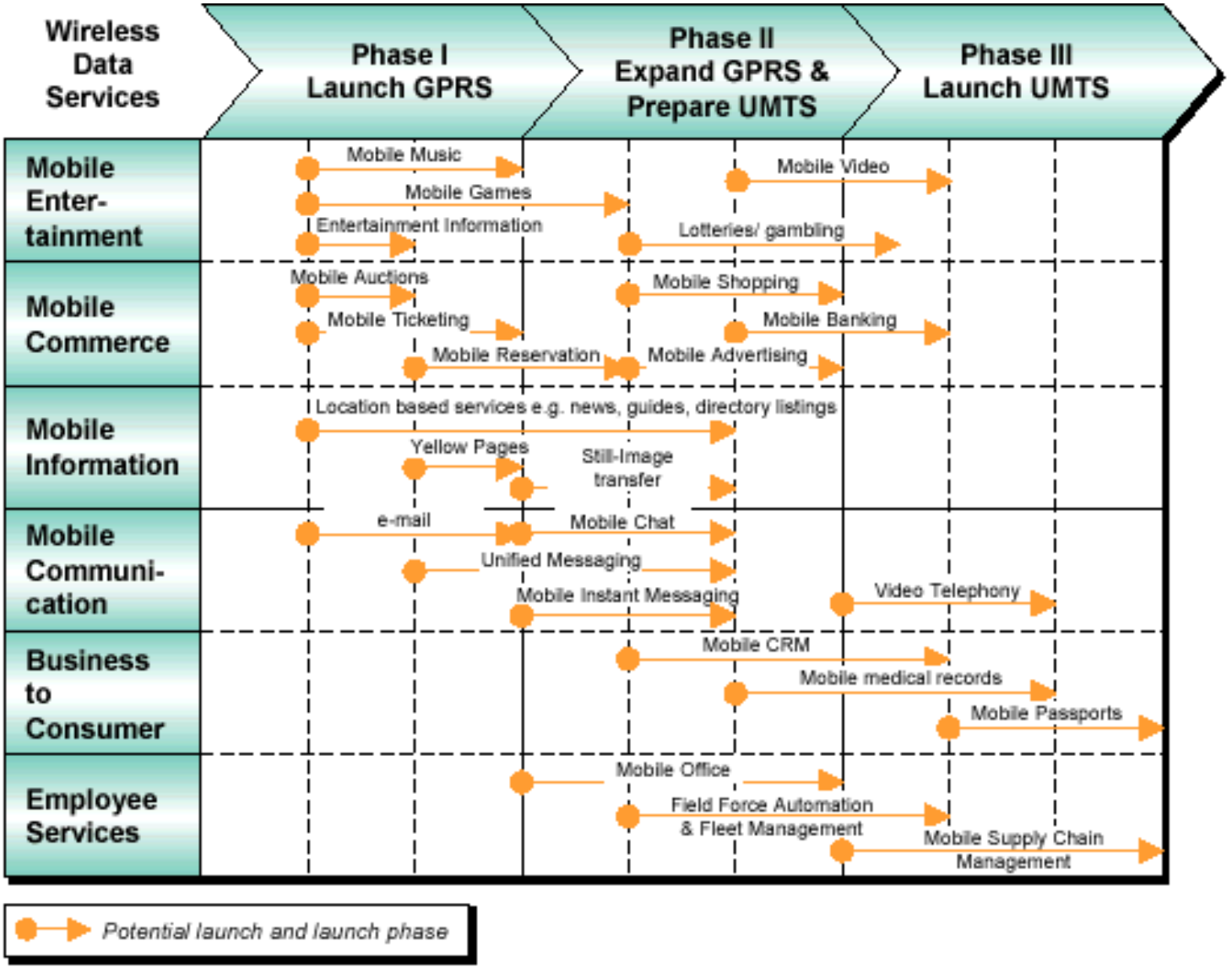
- Field support
- Virtual teams
- E-learning
- Tracking of lone workers
- Social net-working

- Service technicians
- Delivery people
- Outside sales people
  Inspectors
- Insurance adjusters
- lawyers
- medical personnel

Mobile worker – Mobile home alliance

A cross-industry collaboration involving Internet Home Alliance members Cisco, Cushcraft, Herman Miller, Hewlett-Packard, Microsoft, Panasonic and Taubman Centers, the four-month test launched in April 2004 in a 2,400 square foot space in The Shops at Willow Bend in Plano, Texas, a Dallas suburb home to several Fortune 500 companies. In the space, which has been dubbed “Connection Court” and was open to the public, consumers found a mobile work environment complete with free wireless Internet access; laptops; business services, such as copying, printing, scanning and e-mail faxing; live business news and stock reports on 52-inch plasma screens; conference tables and ergonomic Herman Miller furniture designed specifically for the mobile work style.

Υπηρεσίες και εφαρμογές



mobile gaming

QuickTime™ and a TIFF (LZW) decompressor are needed to see this pic

- **SMS based real world action game - assassin on steroids!**
- **Use website to get a new mission/target. Go to location, phones position tracking let's you know if you "hit" opponent. The phone becomes invisible, a remote control, a radar system**
- **The world becomes the game - http://www.itsalive.com**

games that integrate camera

- korea, action game
- use your photos to create characters
- depending on the photo different attributes: life,power, speed.
- you can also infrared the photos and play against other people. you can add comments and these will get transferred as your “warrior” if you IR the photo to someone else.

meta-content

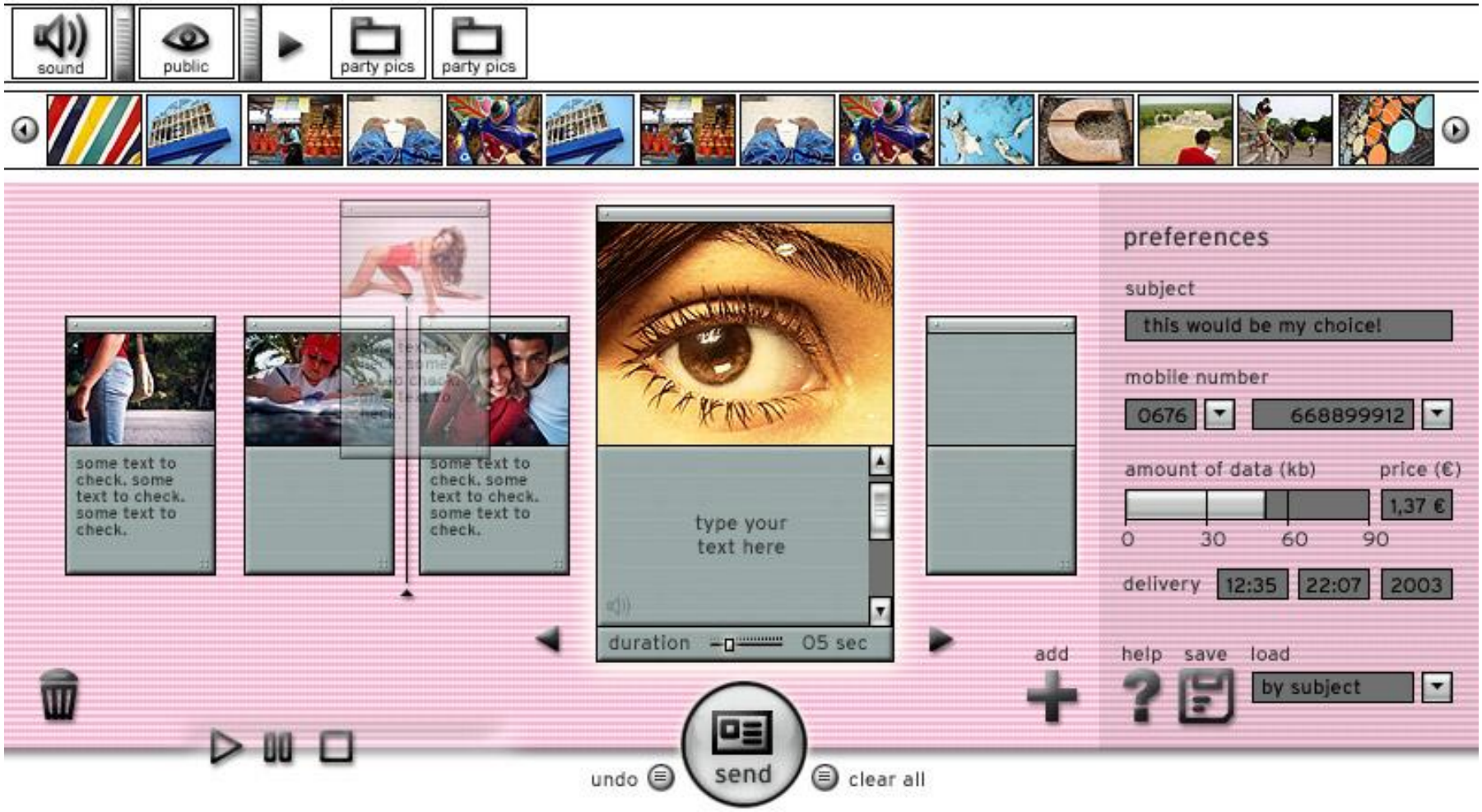
- **person to person communication will always be the major part of human communication, just like the one and only existing killer application “voice”.**
- **introducing “meta-content”**
  we refer to this term, when we describe the output of applications the consumer can access, so he can produce his own content.
- **existing applications on todays phones:**
  - voice and microphone
  - keypad and sms editor
  - mms editor (just to send photos)
  - music composers (do not even try)
- **if new applications are carefully designed for ease of use, consumers will adopt them quickly and produce content for their friends, family, themselves.**

application examples of user generated content

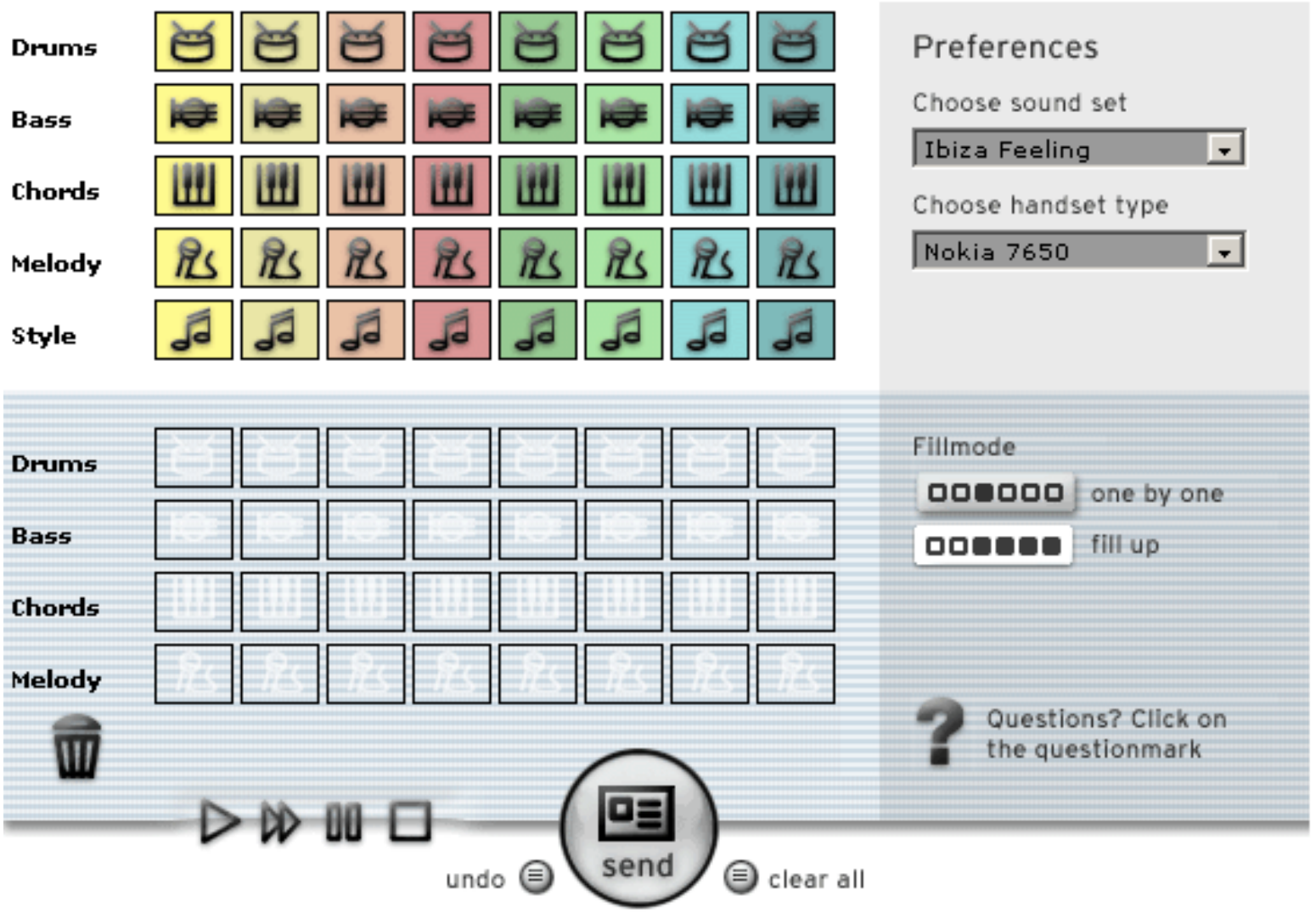
- **Mobile Blogging**
- **Mobile Chat**
- **User Generated Graphic Content**
- **SMS, MMS**
- **User Generated Ring Tones**
- **Mobile Gaming**

- **User generated content is the most compelling content:**
  - It‘s free.
  - It‘s real.
  - It makes Digital Rights Management much easier.

Future mobile services include text, graphic content/photos & sound



Consumers create their own polyphonic ring tones



blogging: publish from your phone, anytime !

- send text, photos, captured sound and videos to the web
- publish in private blog, and also to friends
- edit and browse with the phone and web
- instant communication

and this results in millions of created private webpages.

Support of MMS

Επιχειρηματικά Μοντέλα για κινητές επικοινωνίες 3ης/4ης γενιάς

nancy@di.uoa.gr

Vision of 3G/4G Service provision

siemens-mobile_e2e_technology_that_convinces.wmv

Vision of 3G/4G Service provision

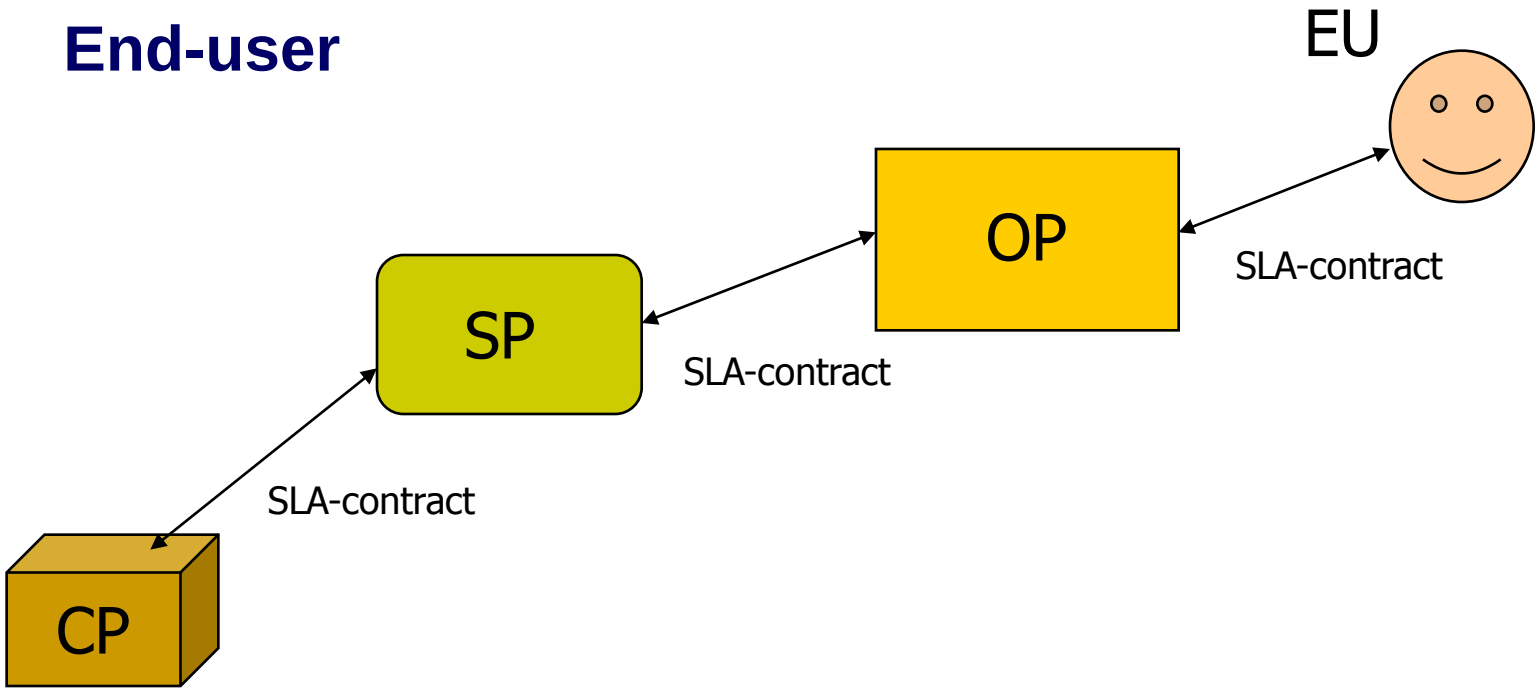
Βασική αλυσίδα αξίας επιχειρηματικού μοντέλου για παροχή υπηρεσιών

Content provider

Service/Application developer/provider

Network Operator

End-user



Service Level Agreement

Ενα service level agreement είναι ένα κείμενο που καθορίζει τις σχέσεις μεταξύ δύο μερών: του προμηθευτή και του καταναλωτή (the provider and the recipient).

This is clearly an extremely important item of documentation for both parties. If used properly it should:

- Identify and define the customer's needs
- Provide a framework for understanding
- Simplify complex issues
- Reduce areas of conflict
- Encourage dialog in the event of disputes
- Eliminate unrealistic expectations

Service Level Agreement

SLA should embrace a wide range of issues. Amongst these are usually the following:

- **Services to be delivered**
- **Performance, Tracking and Reporting**
- **Problem Management**
- **Legal Compliance and Resolution of Disputes**
- **Customer Duties and Responsibilities**
- **Security**
- **IPR and Confidential Information**
- **Fees and expenses**
- **Termination**

Content Provision

- Content Source
- Content Provision Toolkit
- Digital Rights Management
- Service/Network Provider
- User – Content delivery
- Automated Procedures

Content provision

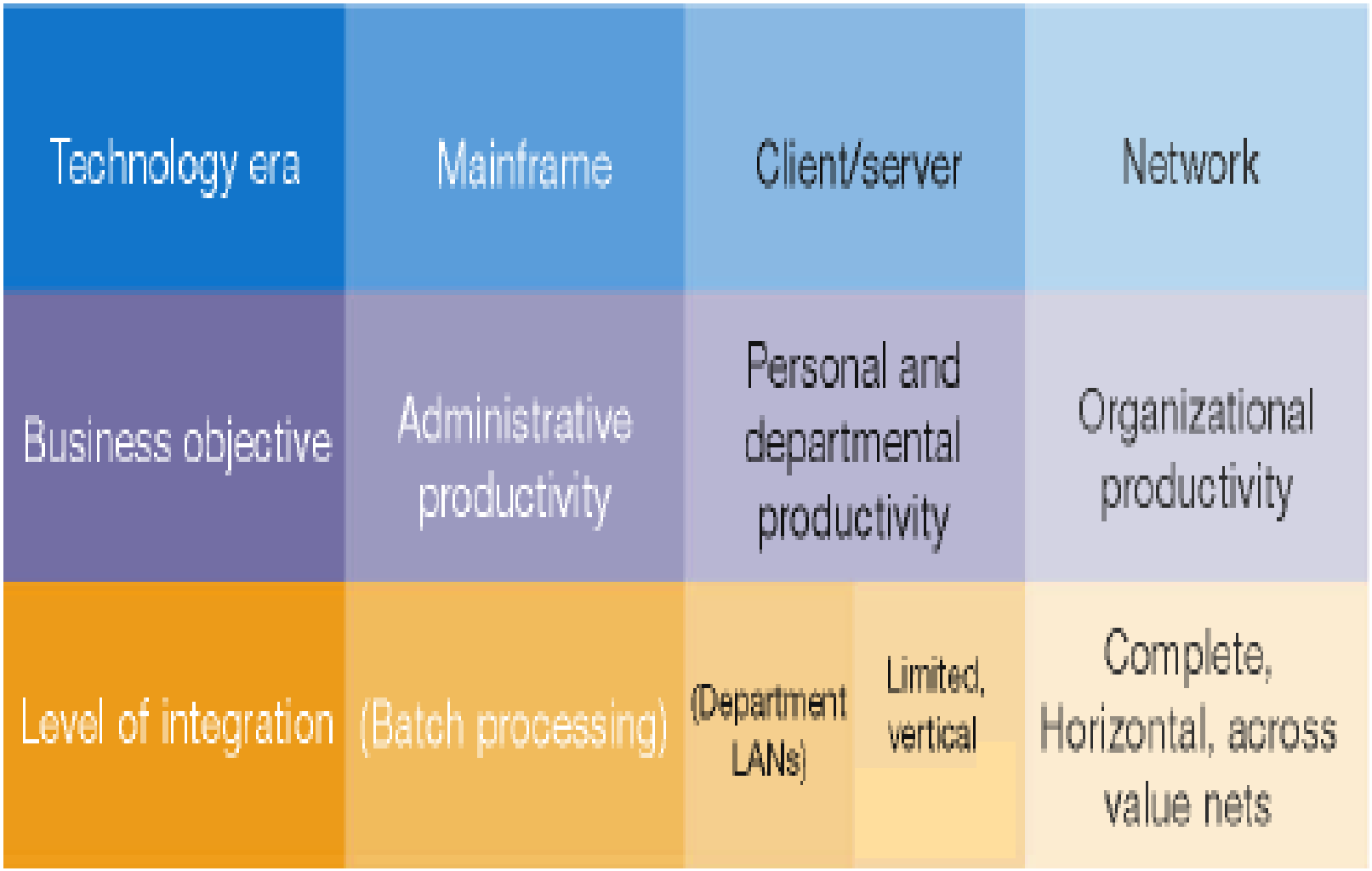
Content provision SP/user interaction

What is e-Business on Demand

"An enterprise whose business processes—integrated end-to-end across the company and with key partners, suppliers and customers—can respond with speed to any customer demand, market opportunity or external threat."

—Sam Palmisano

E-Business on Demand



Service/Applications Development

Developers groups:

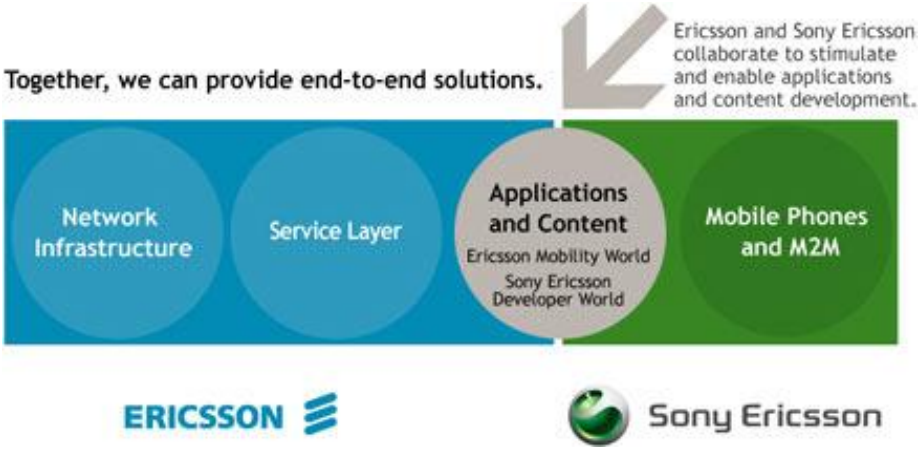
Sony/Ericsson

Nokia

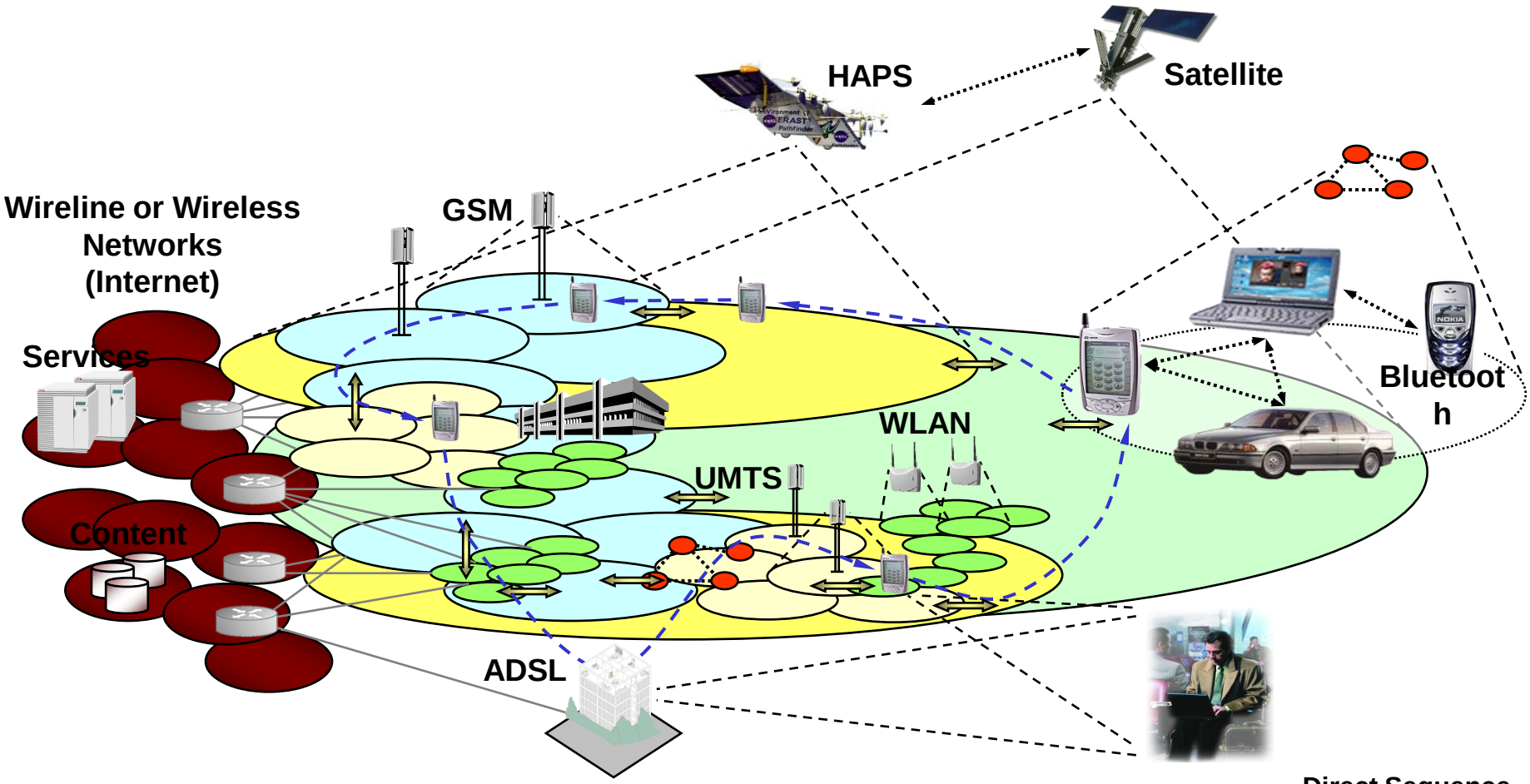
DoCoMo

Telefonica

etc



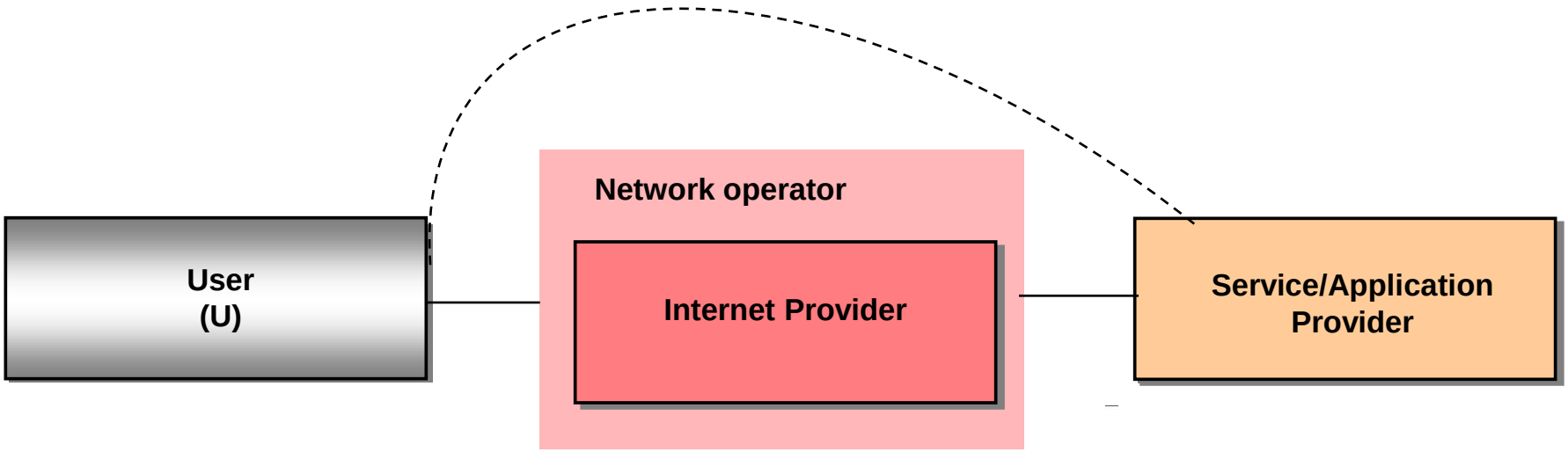
Σύστημα επικοινωνιών 4ης γενιάς



Απαιτήσεις για ευέλικτη παροχή υπηρεσιών στις κινητές επικοινωνίες 4ης γενιάς

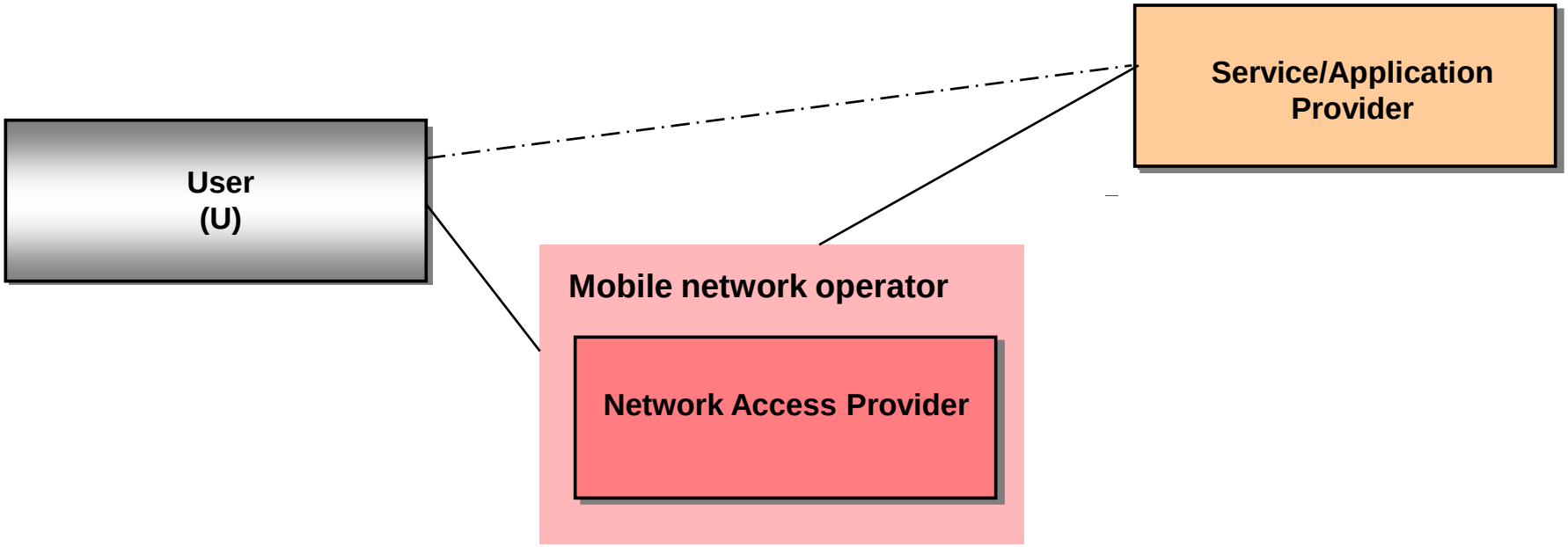
- Υποστήριξη ευέλικτων επιχειρηματικών μοντέλων
- Σύγκλιση των κόσμων του Ιντερνετ και των Κινητών επικοινωνιών
- Απρόσκοπτη πρόσβαση (μέσω οποιουδήποτε συστήματος) σε υπηρεσίες (multimedia, content rich, downloadable services)
- Δυναμική ανακάλυψη και χρήση υπηρεσιών από τους χρήστες
- Ευέλικτα μοντέλα χρέωσης
- Ασφάλεια και προστασία του χρήστη και των IPR του παρόχου της υπηρεσίας
- Υποστήριξη ποιότητας υπηρεσίας

Βασικό Επιχειρηματικό Μοντέλο στο Ιντερνετ



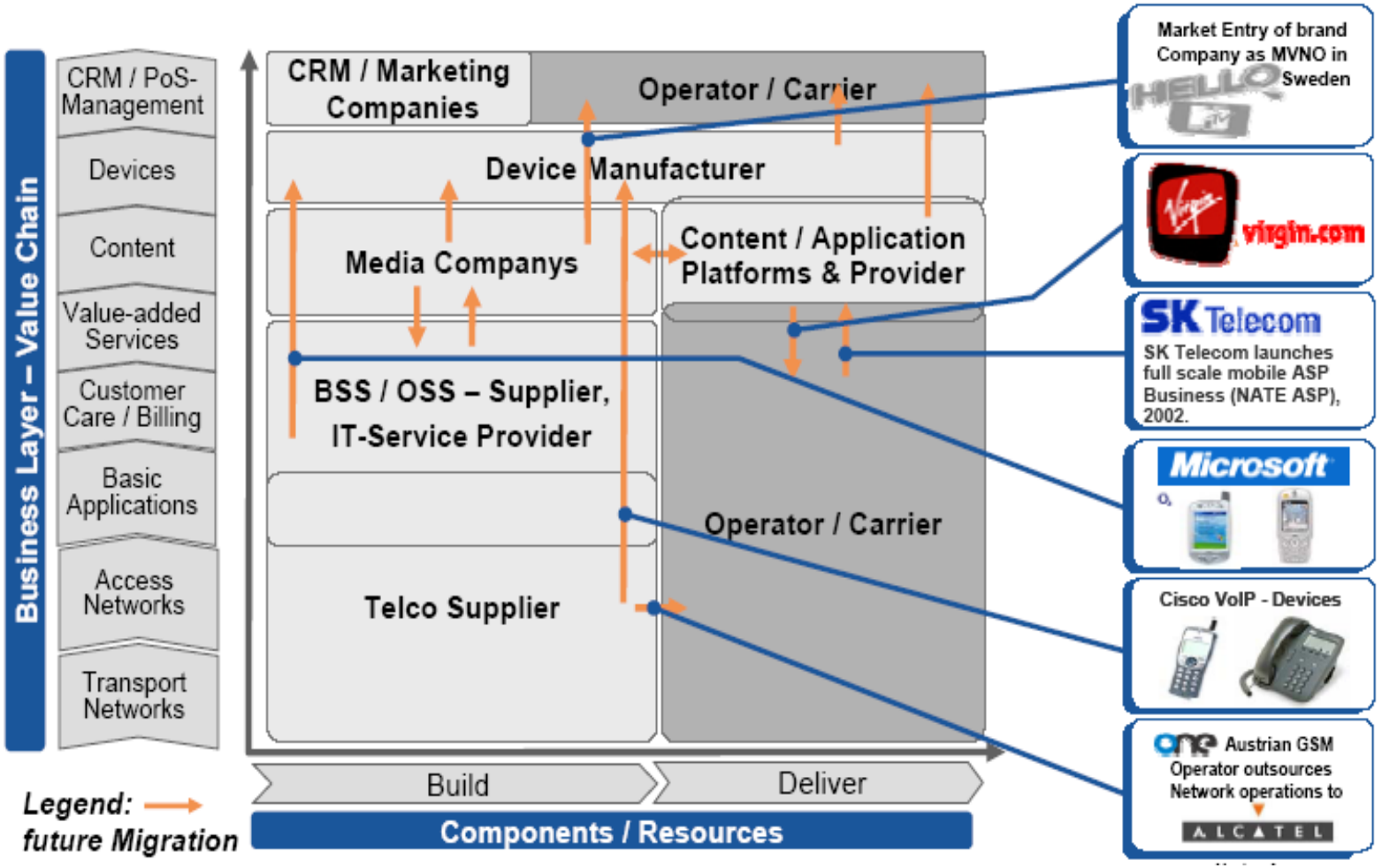
- Αρκετή ευελιξία στην εισαγωγή και παροχή νέων υπηρεσιών και περιεχομένου
- Δυναμική ανακάλυψη και εγγραφή σε υπηρεσίες

Βασική σύγκλιση επιχειρηματικών μοντέλων



The end of the classical Value Chain
Fragmentation of the Value Chain and fading Frontiers

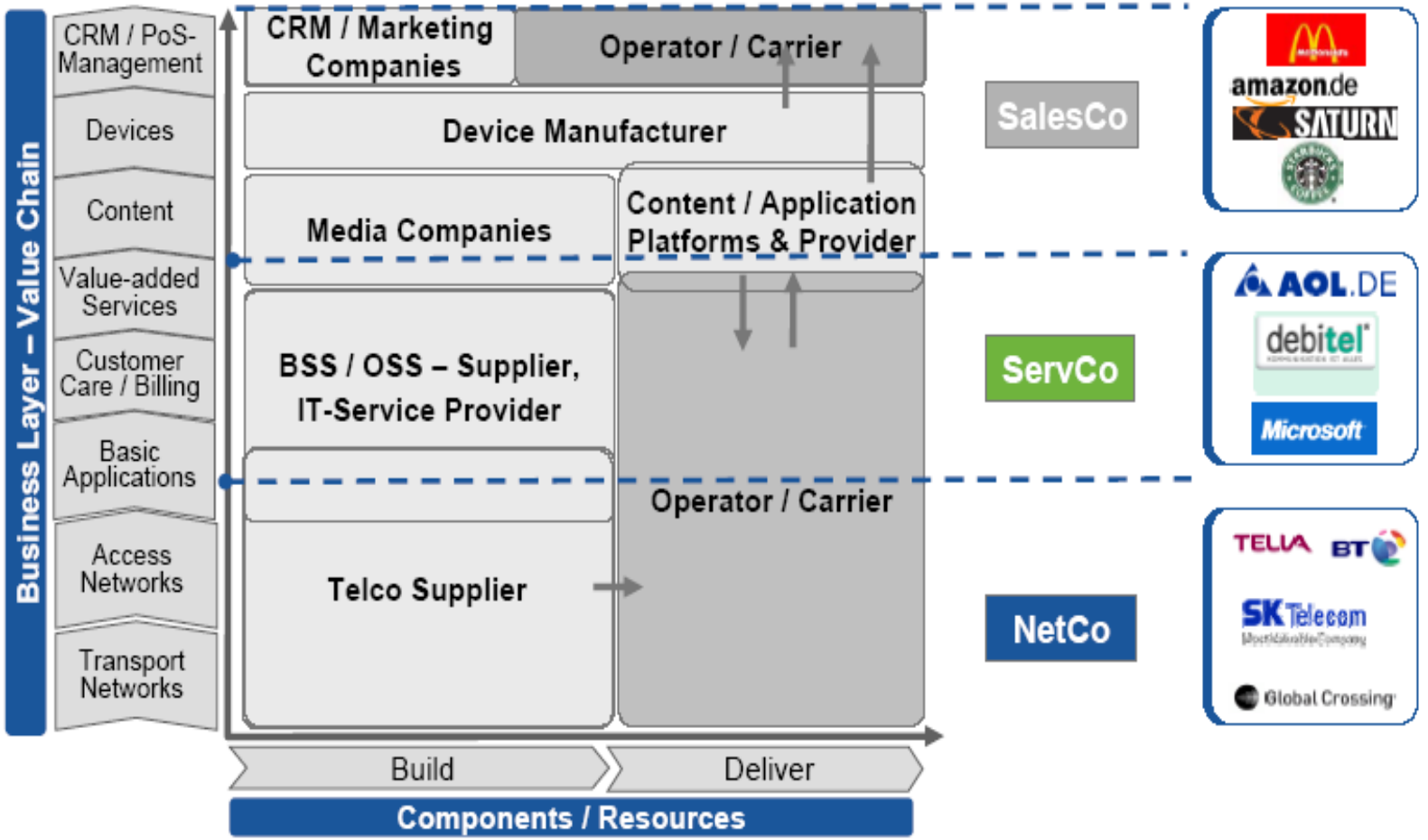
Telcos will come under pressure by new service providers and the backward and forward integration of manufacturers and Content&Application Providers.



The end of the classical Value Chain

Different layers of the value chain require a focused strategic positioning

We expect that Carriers will finally face competition on three different levels and only focused players on each level will be successful.



Conclusions

- Highly complex business environment
- Integration of Business models
- Integration of business players
- Integration of pricing and charging schemes
- The ultimate goal: FLEXIBILITY

Χαρακτηριστικά του UMTS

- Κοινή παγκόσμια χρήση
- Υποστήριξη όλων των εφαρμογών
- Υποστήριξη PS (Packet Switched) & CS (Circuit Switch)
- Ρυθμοί μετάδοσης μέχρι 2Mbps (κινητικότητα - ταχύτητα)

WCDMA (Wideband Code Division Multiple Access)

- 384 Kbps wide area coverage
- 2 Mbps local area coverage
- 10 ms frame length
- Chip rate = 3.84 Mchips/s
- FDD (Frequency Division Duplex)

Uplink 1920-1980MHz;Downlink 2110-2170MHz

Uplink 1850-1910MHz;Downlink 1930-1990MHz

- TDD (Time Division Duplex)

Διαδικασίες προτυποποίησης UMTS

IMT 2000 (ITU): International Mobile Telecommunications 2000: initial trial systems & 2000MHz

- 17 διαφορετικές προτάσεις κατατέθηκαν στην ITU το 1998
- 11 terrestrial & 6 Mobile satellite systems
- Αξιολόγηση των προτάσεων (τέλος του 1998)
- Διαπραγματεύσεις για συνένωση τους (6/1999)
- Προδιαγραφές για την ραδιο-τεχνολογία μετάδοσης (τέλος του 1999)

- Πιο σημαντικές προτάσεις:
- UMTS (W-CDMA): μετεξέλιξη του GSM
- CDMA2000: Ενδιάμεσο πρότυπο για το IS-95
- TD-CDMA (Time Division synchronous CDMA): UWC-136/EDGE για την επαύξηση των δυνατοτήτων των D-AMPS και GSM

3GPP
Third Generation Partnership Project

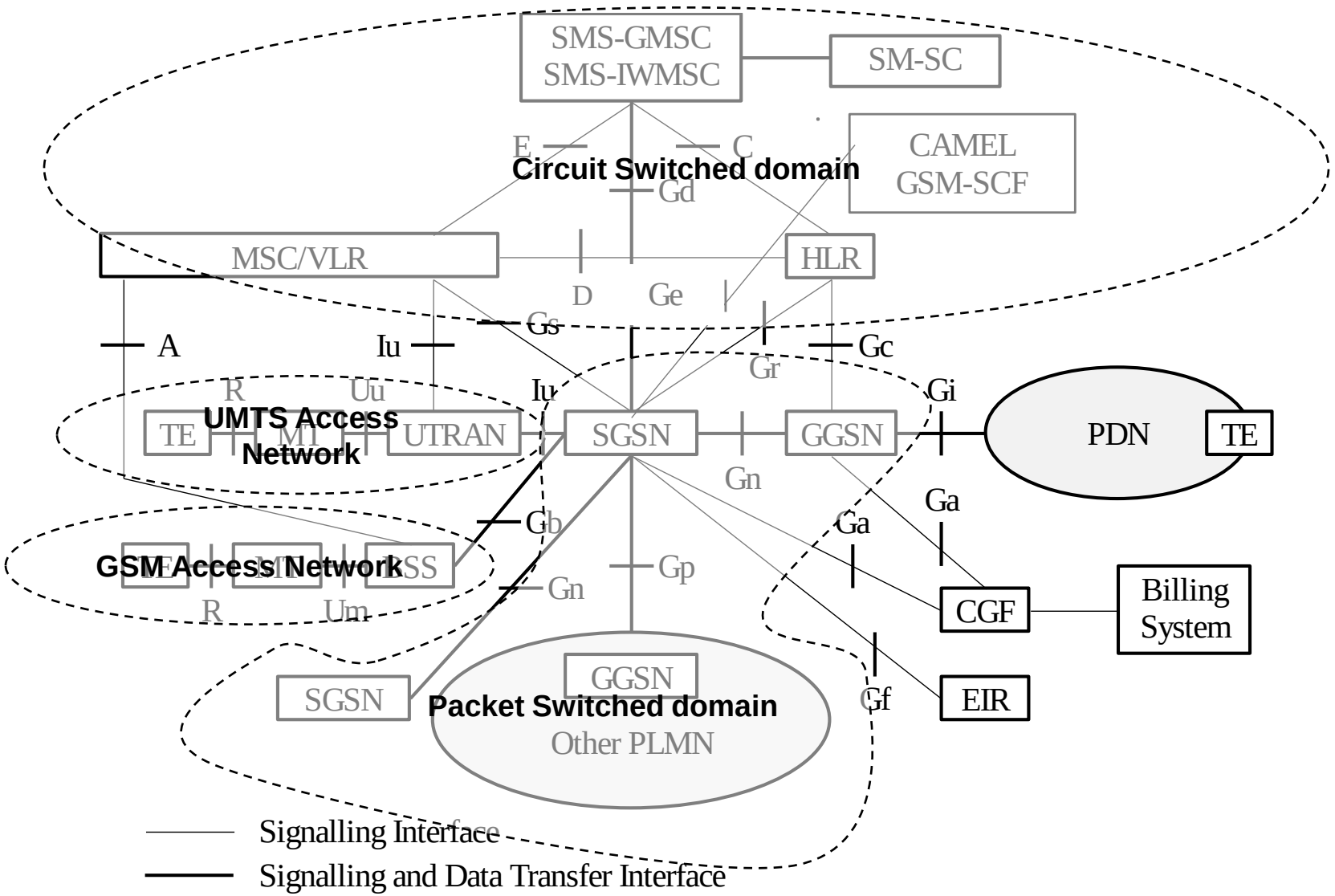
•ETSI (Ευρώπη),
•Association of Radio Industries and Business Telecommunication Technology Committee (ARIB/TTC - Ιαπωνία),
•American National Standards Institute (ANSI - Αμερική), Telecommunication Technology Association (N. Κορέα),
•Chinese Wireless Telecommunication Standard (CWTS).

Εκδόσεις:
Release 99 (12/1999): Μετεξέλιξη του GSM δικτύου
Release 2000: Μετεξελίξεις για το IS-95 και το EDGE; δυνατότητα σύνδεσης με άλλα δίκτυα πρόσβασης (WLAN,BRAN)

Release 99

•UTRAN: UMTS Terrestrial Radio Access Network
•W-CDMA Ραδιοεπαφή
•Υποστήριξη 2 modes of operation:Time Division Duplex & Frequency Division Duplex
•TDD: Micro & Pico κυψέλες καθώς και ασύρματες εφαρμογές
•FDD: Wide-area coverage (public & macro κυψέλες)

Λογική αρχιτεκτονική UMTS



UMTS Services

UMTS offers teleservices (like speech or SMS) and bearer services, which provide the capability for information transfer between access points. It is possible to negotiate and renegotiate the characteristics of a bearer service at session or connection establishment and during ongoing session or connection. Both connection oriented and connectionless services are offered for Point-to-Point and Point-to-Multipoint communication.

Bearer services have different QoS parameters for maximum transfer delay, delay variation and bit error rate. Offered data rates targets are:

144 kbits/s satellite and rural outdoor

384 kbits/s urban outdoor

2048 kbits/s indoor and low range outdoor

Κλάσεις και παράμετροι QoS

Ορισμός κλάσεων βάσει: delay, bit rate, bit error rate, traffic handling priority requirements

Conversational Class: Fixed resource allocation
Παράδειγμα:Video telephony, video gaming
Streaming Class: Tolerance to a certain amount of delay variation
Παράδειγμα:Video Downloading, webcast
Interactive Class: Services requiring assured response times (scheduling priority)
Παράδειγμα:E-commerce, web browsing
Background Class: Best effort services (lowest priority)
Παράδειγμα:file transfer, E-mail, SMS

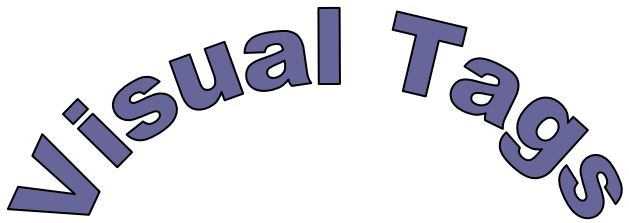
Κλάσεις και παράμετροι QoS

Traffic parameters	Conversational class	Streaming class	Interactive class	Background class
Maximum bit rate	X	X	X	X
Guanteed bit rate	X	X		
Maximum service data unit (SDU) size	X	X		
SDU format information	X	X		
SDU error ratio	X	X	X	X
Residual bit error radio	X	X	X	X
Delivery of errorneous SDUs	X	X	X	X
Delivery order (y/n)	X	X	X	X
Transfer delay	X	X		
Traffic handling priority			X	
Admission/retention priority	X	X	X	X

Mobile TV

Source NOKIA

Visual Tags



Source VTT

Sports view services

Sports view services

The target user of this application/service is a remote spectator equipped with a PDA terminal . He/she will have several means to follow the match in real-time or afterwards.

In real-time: view of the whole football field with animated players and the ball, or a video view from any of the cameras installed around the field.

Off-line: replays of his/her choice on specific situations, e.g. shots on goal, either as animated or video-based.

In addition the user has access to various relevant information, like match statistics and team or player data. This kind of service could also involve advertising and specific betting opportunities, which add to its business potential.

Implementation of the pilot system requires several cameras installed around the field. This is crucial for the technically most difficult task of the application, i.e. for detecting and tracking the players and the ball. But this camera array also makes possible for the user to watch the video view of his/her personal choice.

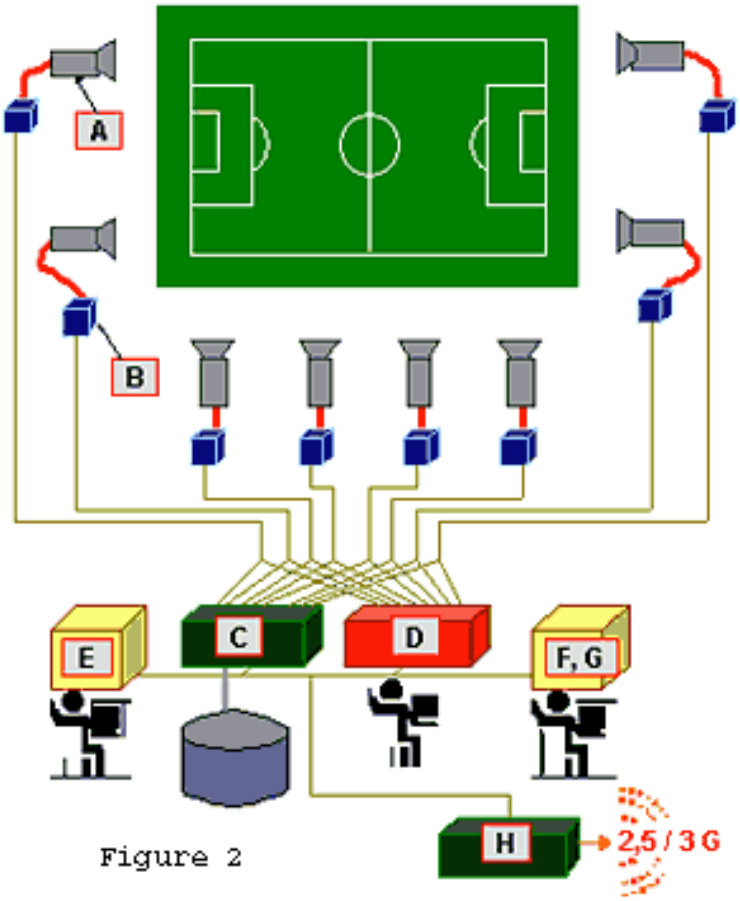
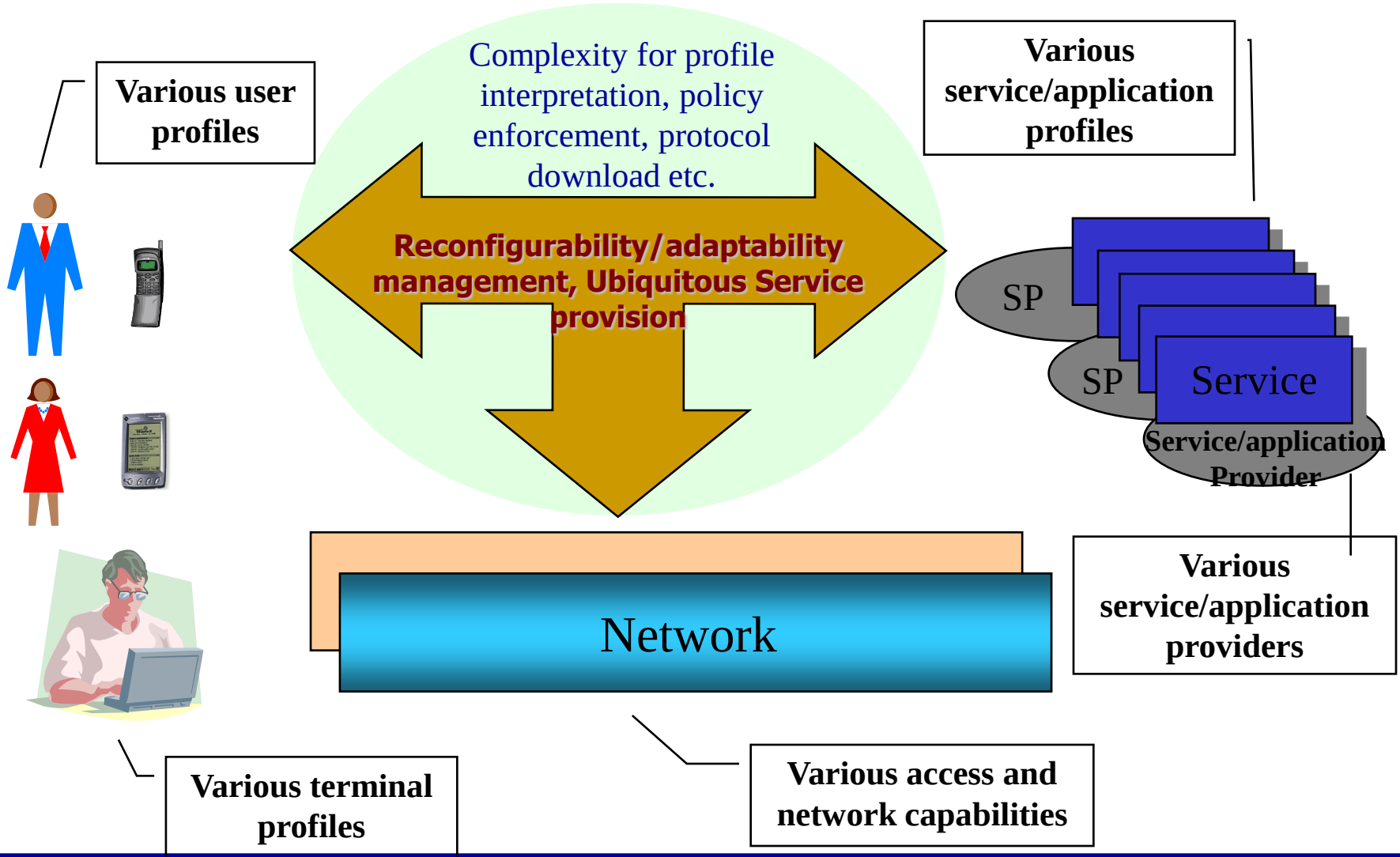


Figure 2

Reconfigurabillity/Adaptability – Γιατί;



Απαιτήσεις για την εισαγωγή δυναμικά αναπροσαρμοζόμενων δικτύων και υπηρεσιών

ADAPTABILITY

Support for flexible business models with novel dynamic services

Convergence towards an IP-based core network and ubiquitous, seamless access

Dynamic service registration, deployment and update by Service Providers (SPs)

Dynamic user registration

Support for QoS, flexible security schemes

Support for flexible charging/accounting models

Advanced profile management (user/service/network/terminal/charging/security)

Context aware and adaptable service deployment

Advanced Service discovery - based on various parameters, e.g.:

- Terminal capabilities
- User profile
- Service profile
- Location etc.

Dynamic reconfiguration/adaptation based on:

profiles, service provision requirements

MT/access/network capabilities

policy provision (charging, QoS etc.)

context information (e.g., terminal, network, user preferences and status

RECONFIGURABILITY

Τι είναι η δυναμική αναδιαμόρφωση

Η δυναμική…

- δημιουργία στιγμιοτύπων,
- παραμετροποίηση και
- διασύνδεση

λειτουργικών οντοτήτων (π.χ. protocol instances) μέσα στα επίπεδα

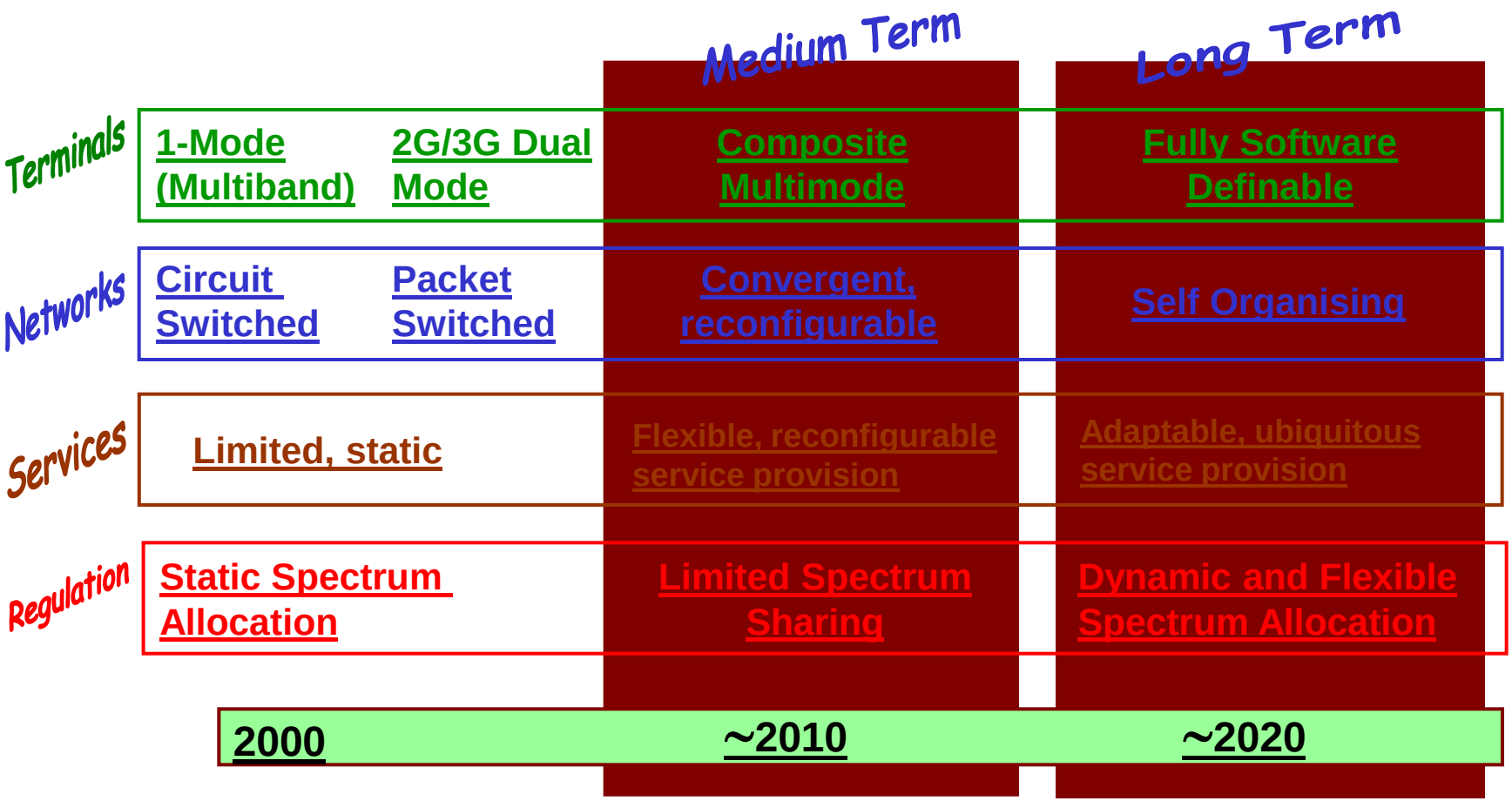
- χρήστη,
- ελέγχου και
- διαχείρισης,

ενός συστήματος επικοινωνιών με τρόπο

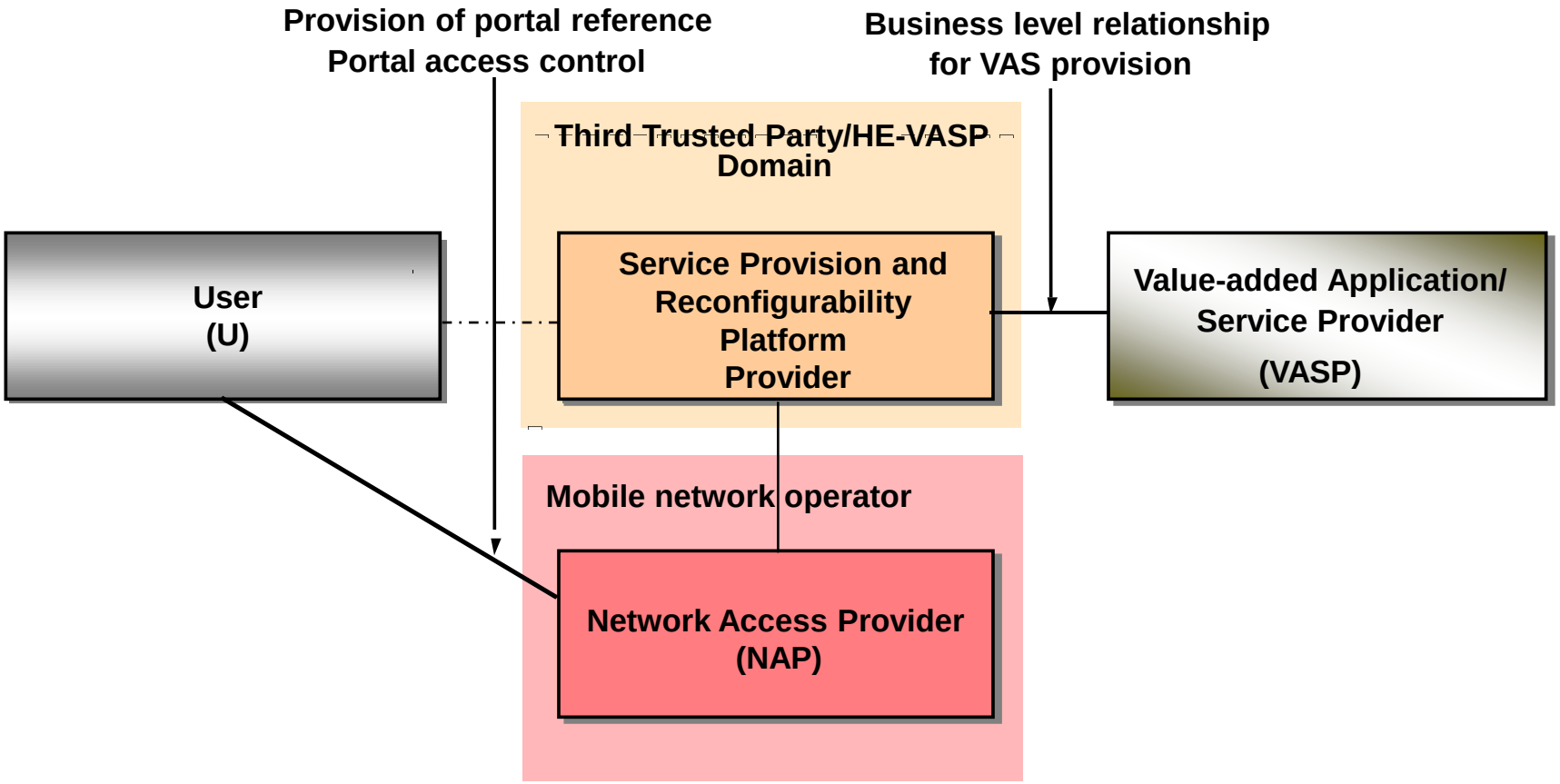
- διαχειρίσιμο,
- ακέραιο και
- διαφανή

Road-map

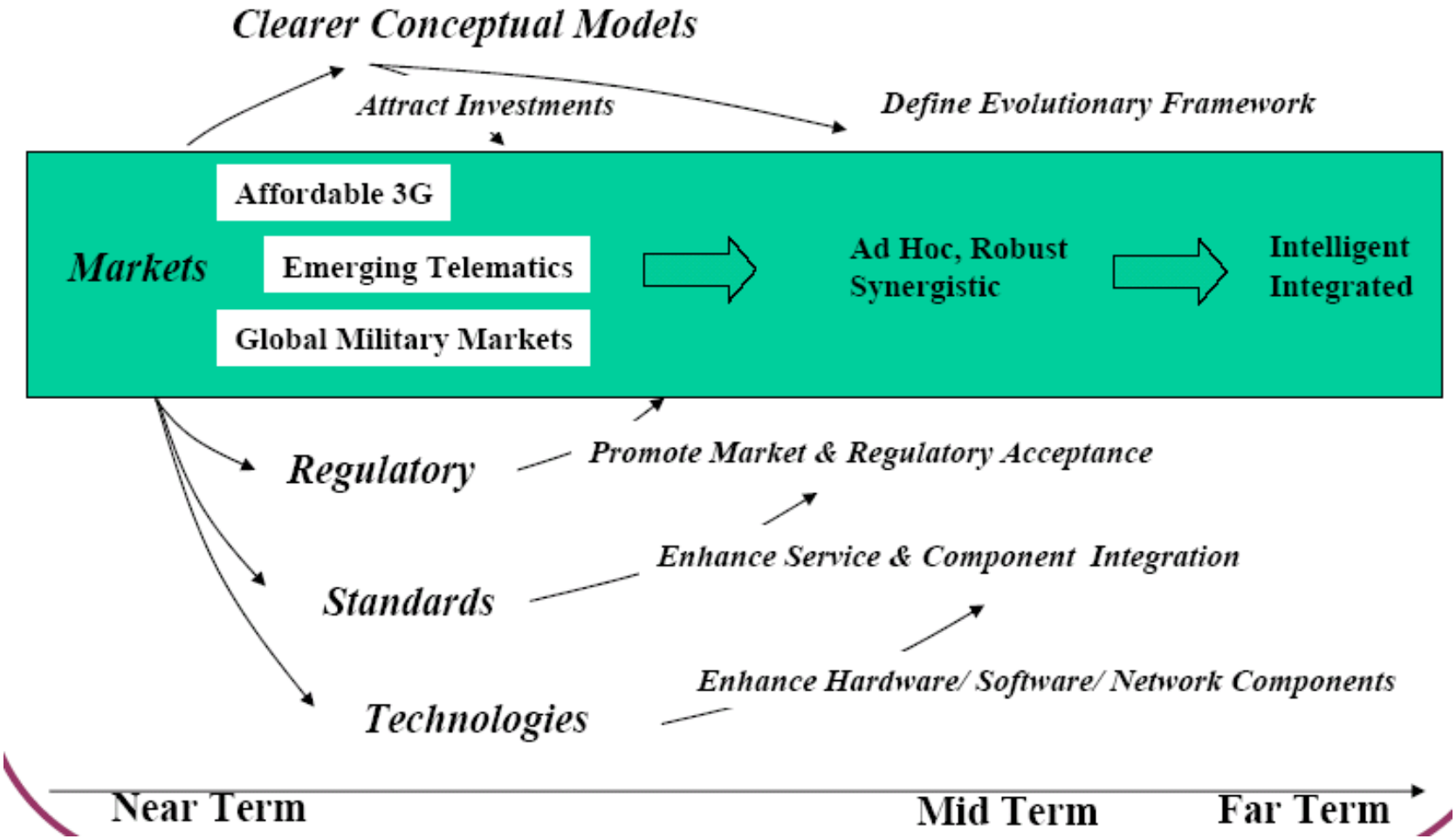
Terminal, networks, services and regulation evolutions



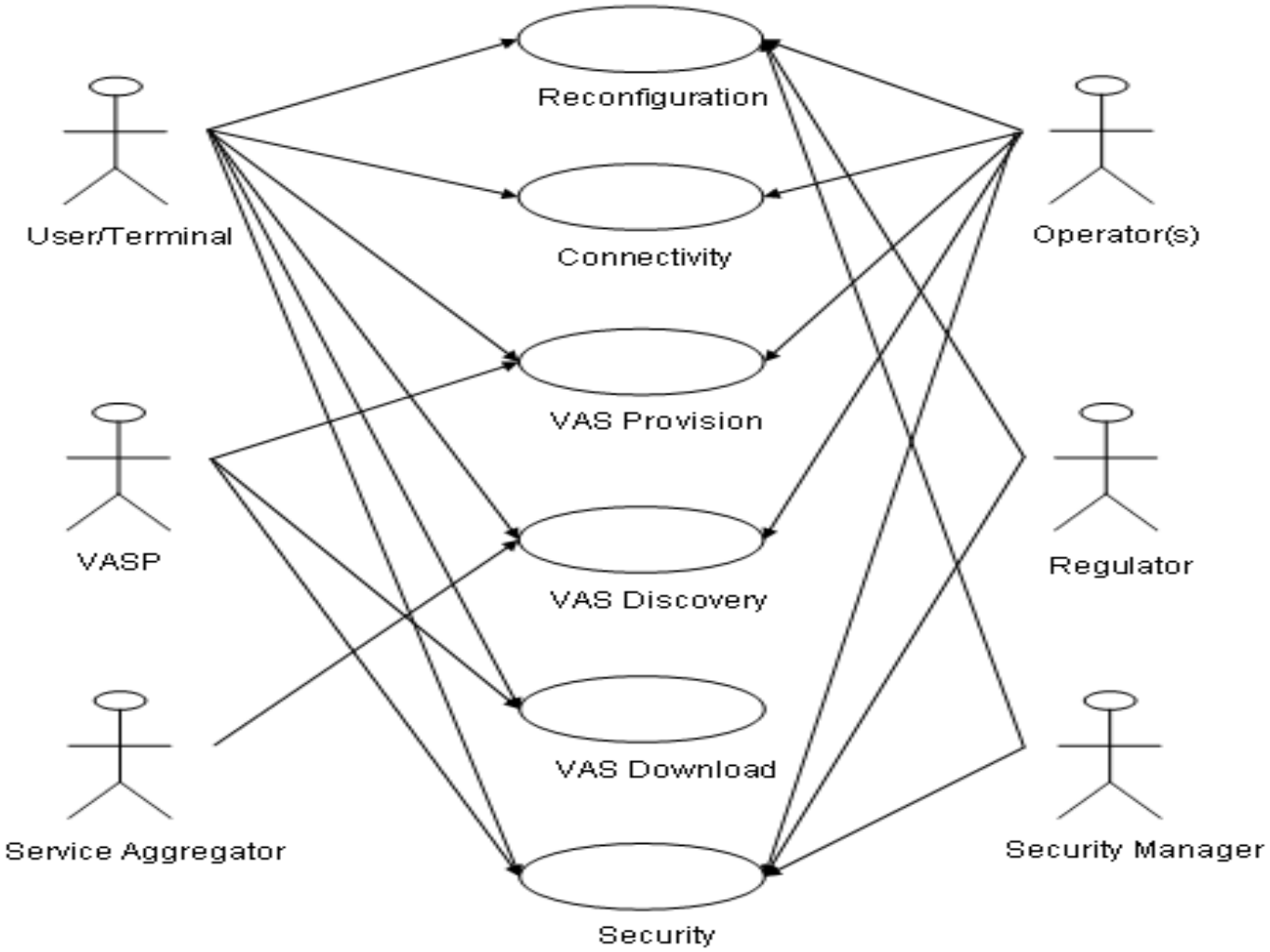
Business model for flexible service provision through Service Provision and Reconfigurability Middleware



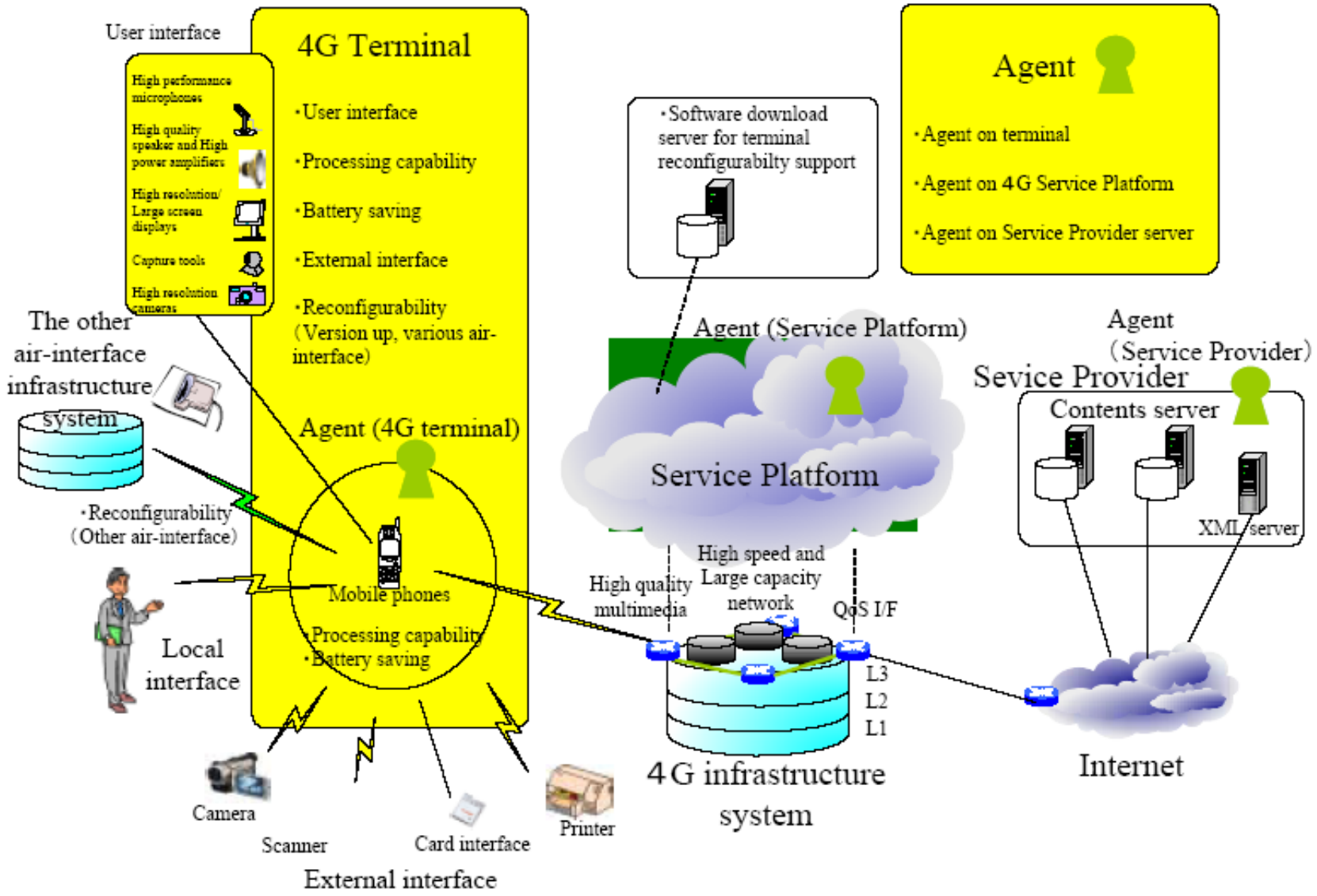
Roadmap


Clearer Conceptual Models
Attract Investments
Define Evolutionary Framework
Affordable 3G
Markets
Emerging Telematics
Global Military Markets
Ad Hoc, Robust
Synergistic
Intelligent
Integrated
Regulatory
Promote Market & Regulatory Acceptance
Standards
Enhance Service & Component Integration
Technologies
Enhance Hardware/ Software/ Network Components
Near Term
Mid Term
Far Term

Μοντελοποίηση συσχετίσεων φορέων για την από άκρο σε άκρο αναδιαμόρφωση



Business actors for reconfigurable 4G systems (MITF)

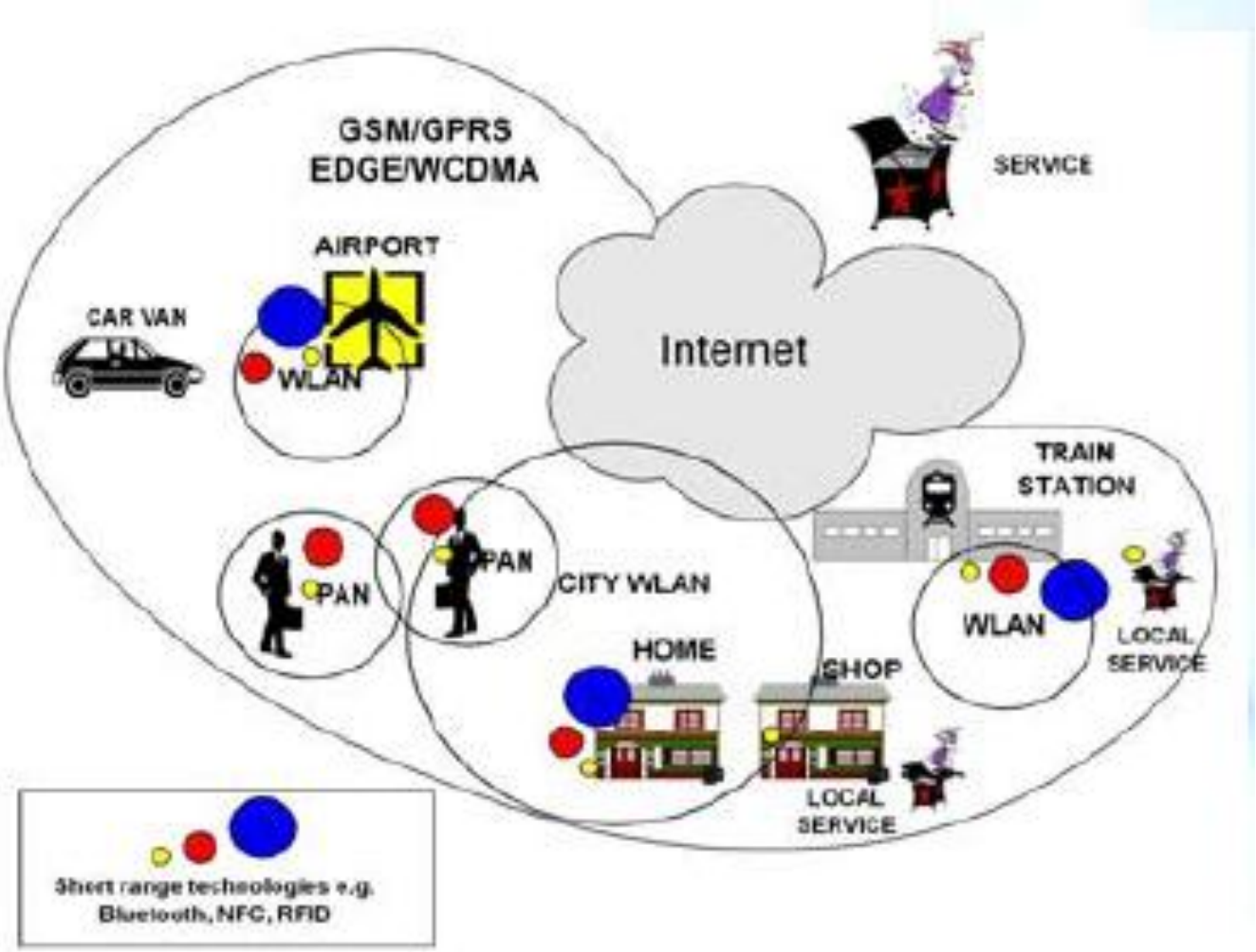


Super 3G – LTE: the vision

Augmented Reality

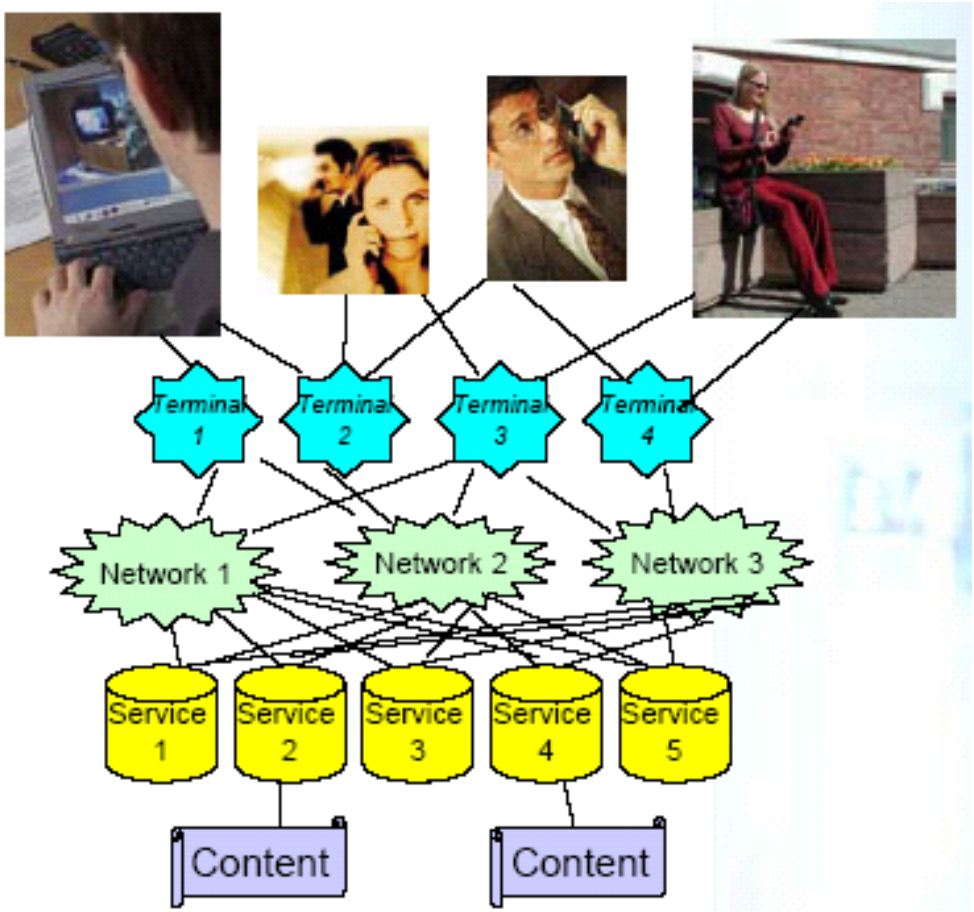
Source VTT

Service delivery



Future wireless services will be accessed in heterogeneous multi-access environment

Multi-network services



All-IP provides interoperability - Services and content are delivered over many networks instead of only one

ABC

The principles of Always Best Connected (ABC):

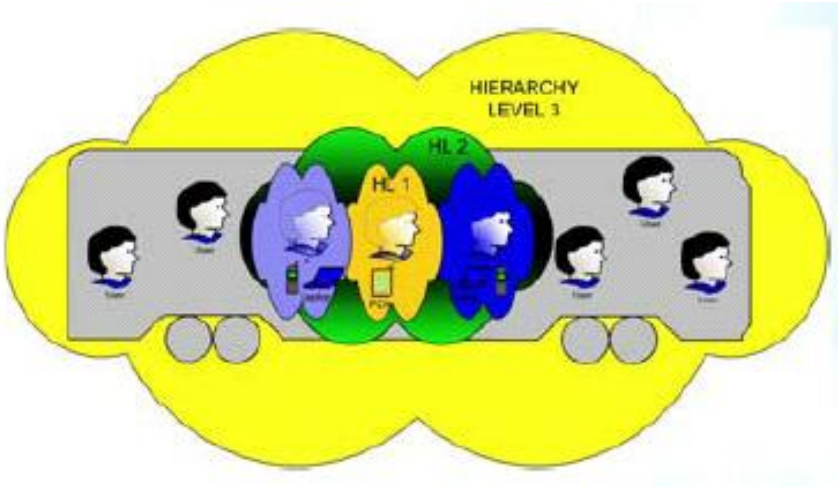
- Seamless (and fast) session roaming between access networks
- Seamless session roaming between different terminals
- Multiple sessions management through different radio interfaces
- Continuous quality of service and fallback solutions
- Unified AAA and security
- Heterogeneous network engineering

Video services

- The video content delivery services are becoming important market area in both mobile and fixed networks
- Large share of video is created and distributed mobile
- Users create their own content and would like to store, distribute and profit from it
- The amount of multimedia content is overwhelming
- The same video content needs to be retrieved to variety of end terminals

Mobility clusters

- Cluster may be formed e.g. by people who have certain trust relationship e.g. same company
- Clusters may have hierarchy levels (HL)
- Devices in clusters may come and go in ad hoc manner
- Rules and methods are needed for cluster management, mobility and connection to upper hierarchy level (gateway)



Context aware services

Location Based Services

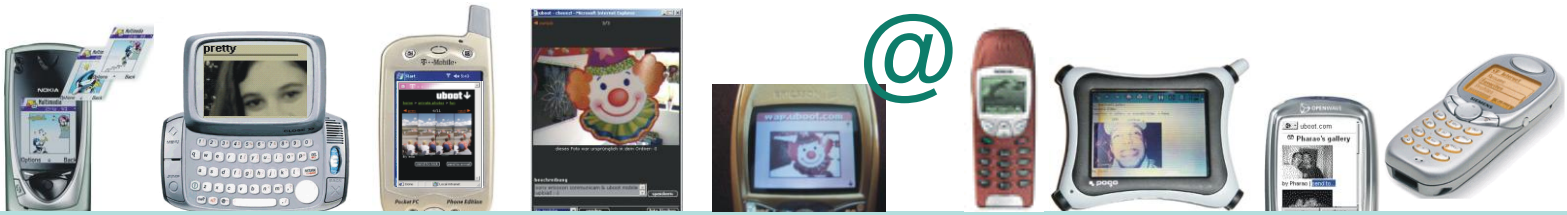
Context management

Context retrieval

Context info:

- location
- resources – e.g., battery
- signal strength
- etc.

Σύγκλιση κινητών επικοινωνιών και του Ιντερνετ



any consumer device

MMS Terminals WAP 1.2 push: WAP ENC

J2ME OTA, offline-online, compose, send, receive

WAP Push handsets WAP 1.2 push, MMS viewed in browser

WAP 1.1 handsets SMS: URL for web access, SMS: Message-ID (WAP1.1)

pictureSMS, logo, text digest of message, URL for WEB **SMS, EMS**

cHTML/HTTP (imode, Pocket PC, Treo, Palm, Danger, Pogo..) **PDA, smartphones**

SMTP, HTML browser **email, PC, WEB**

mobile media platform (VAS)

Mobile Network Operator legacy systems, MMSC,SMSC

Mobile interactive gaming

Source VTT

camsymball_web.wmv

MEXE - 3G mobile multimedia

mobile phones fully internet integrated

- **internet and multimedia services, *on the move***
- **by 2020 more people will be interacting with the WWW via wireless devices than traditional computers (!?)**

- **operator and third party multimedia services**
- **generally no services standardised, but enabled using 3GPP services toolkits (e.g. services toolkits (e.g. MExE MExE, CAMEL, USAT, OSA) and IP/IT toolkits)**
- **new personalised multimedia services rapidly developed to differentiate from competitors**

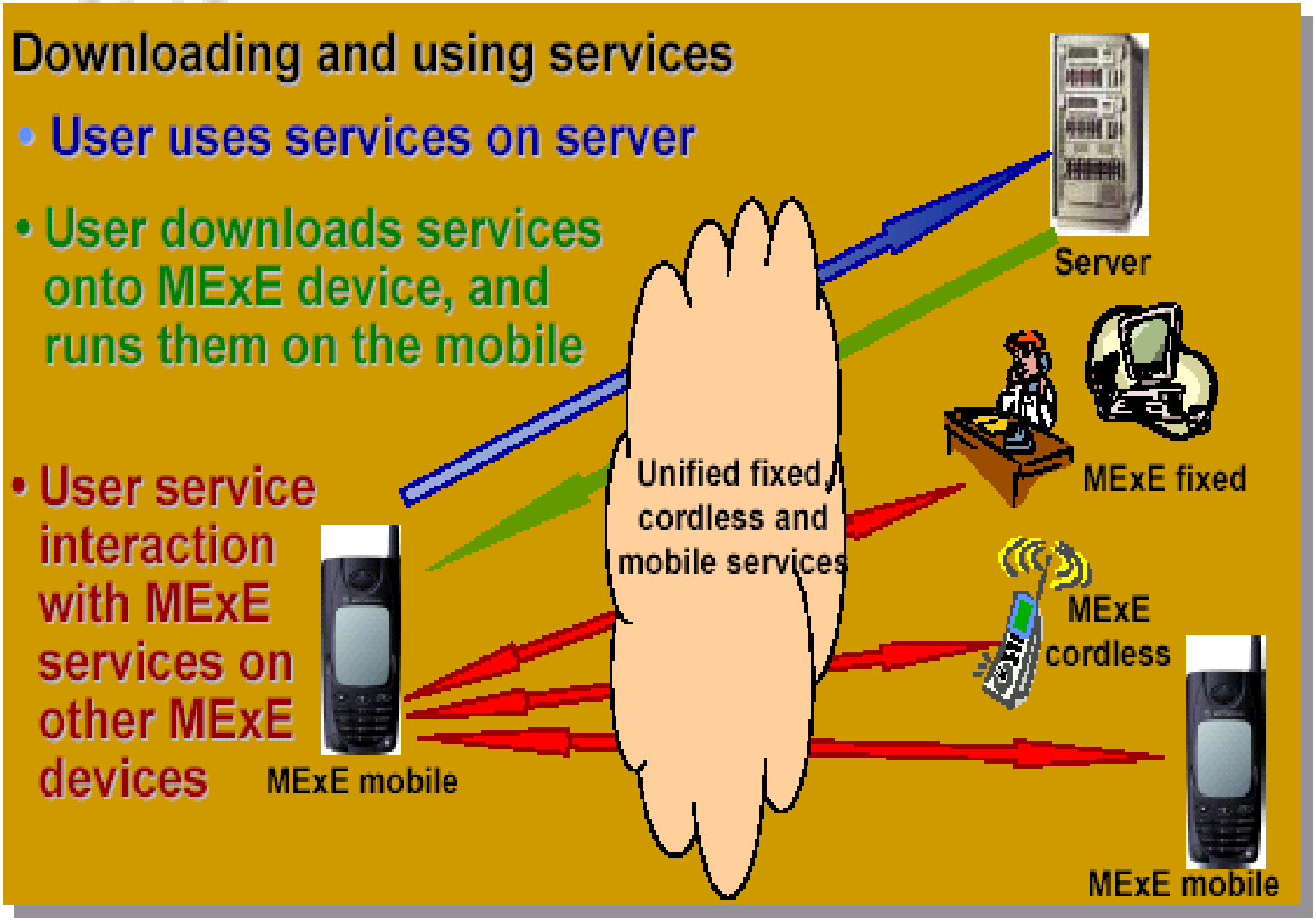
MExE Overview

- **standardised execution environments in a mobile phone**
  - WAP
  - PersonalJava
  - CLDC/MIDP Java (Connected Limited Device Configuration, Mobile Information Device Profile)

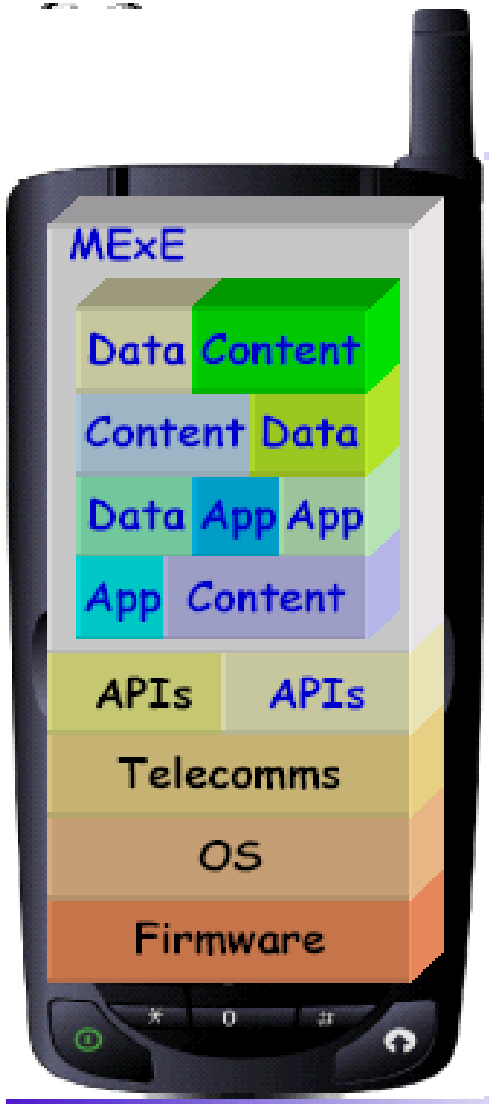
Applicable to 3G, non-3G, cordless and fixed environments

- **IT/IP multimedia services running on mobile phones**
  - write once, execute on many mobile phones
- **transfer of multimedia services**
  - up/downloading, network/3rd party, MExE-to-MExE services
- **standardised negotiation of capabilities with servers**
  - i.e. device type, screen size, memory, bearers etc.

MExE Service Scenarios



MExE Architecture



The MExE framework sits in the mobile phone architecture…

- MExE executables, data and content
- MExE framework (MExE classmark 1, 2, 3)
- APIs: manufacturer, MExE classmark
- GMS/UMTS software
- Mobile phone OS
- Manufacturer's firmware
- Manufacturer's mobile phone unit

Example MExE Device

Example MExE services

- one-touch telephony services

manage making/receiving of calls/messages with friendly personalised GUI on mobile or via user's homepage

call forward, diversion, barring, SMS, UUS, AOC etc. (e.g. "Meeting mode", divert time/day/location based business or personal calls)

phone settings (ringer tone, vibrator, ringer volume) etc.

MExE client

Example MExE services

- advanced mobile services and content

exchange multimedia messages, e-mails with audio, visual and textual attachments using standard internet SMTP, POP3 and IMAP4 protocols

Download and play music, video and multimedia using standard formats (e.g. SDMI, MP3, WMA, MPEG4 etc.)

play your favourite games from different manufacturers

MExE client

Example MExE Services

- financial and commercial services

24 hour monitoring of your personalised share portfolio and world market indices

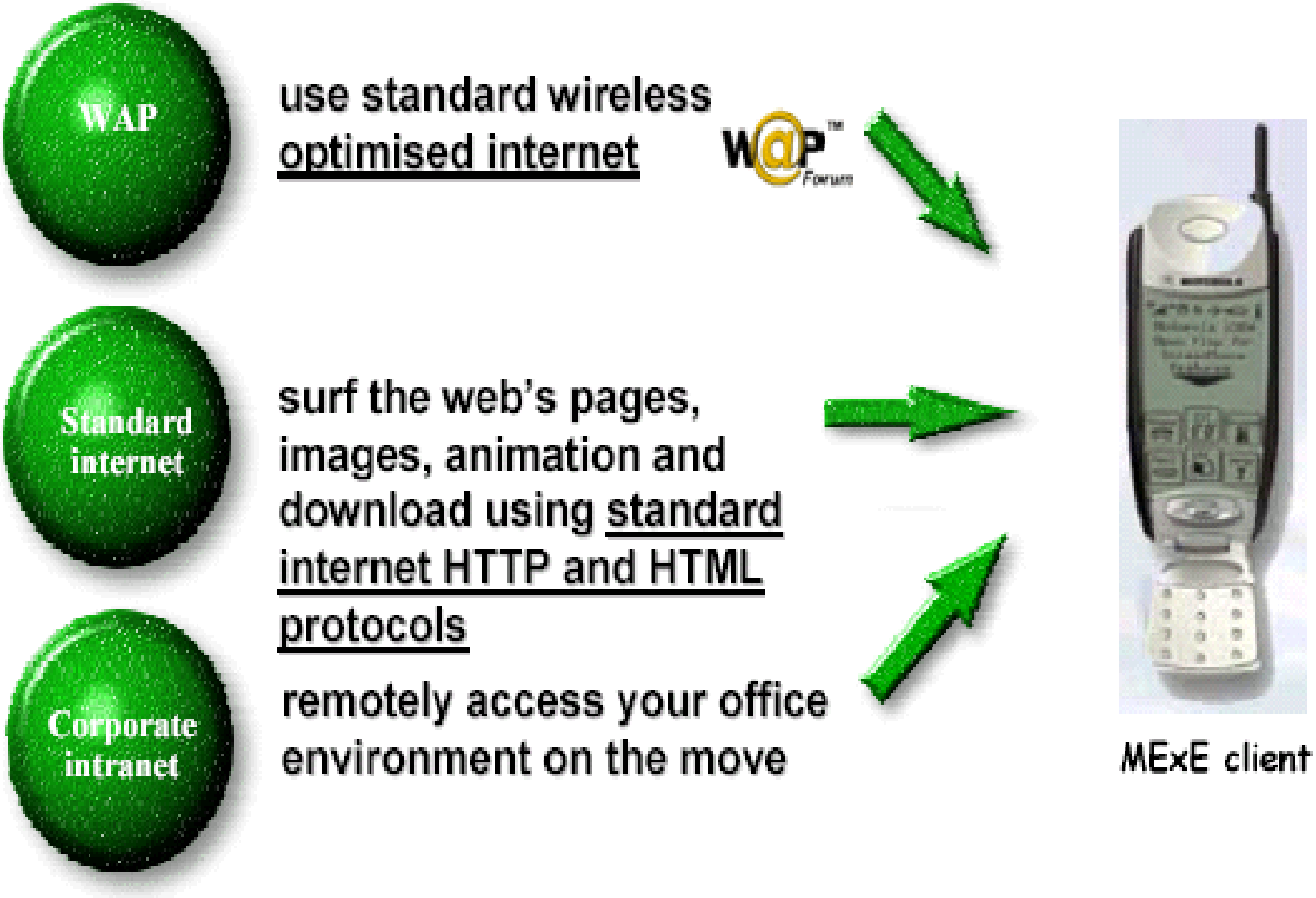
securely buy and sell shares, products and services; location based shopping information

keep track of your favourite sports team and games results; electronic books and personalised newspapers

MExE client

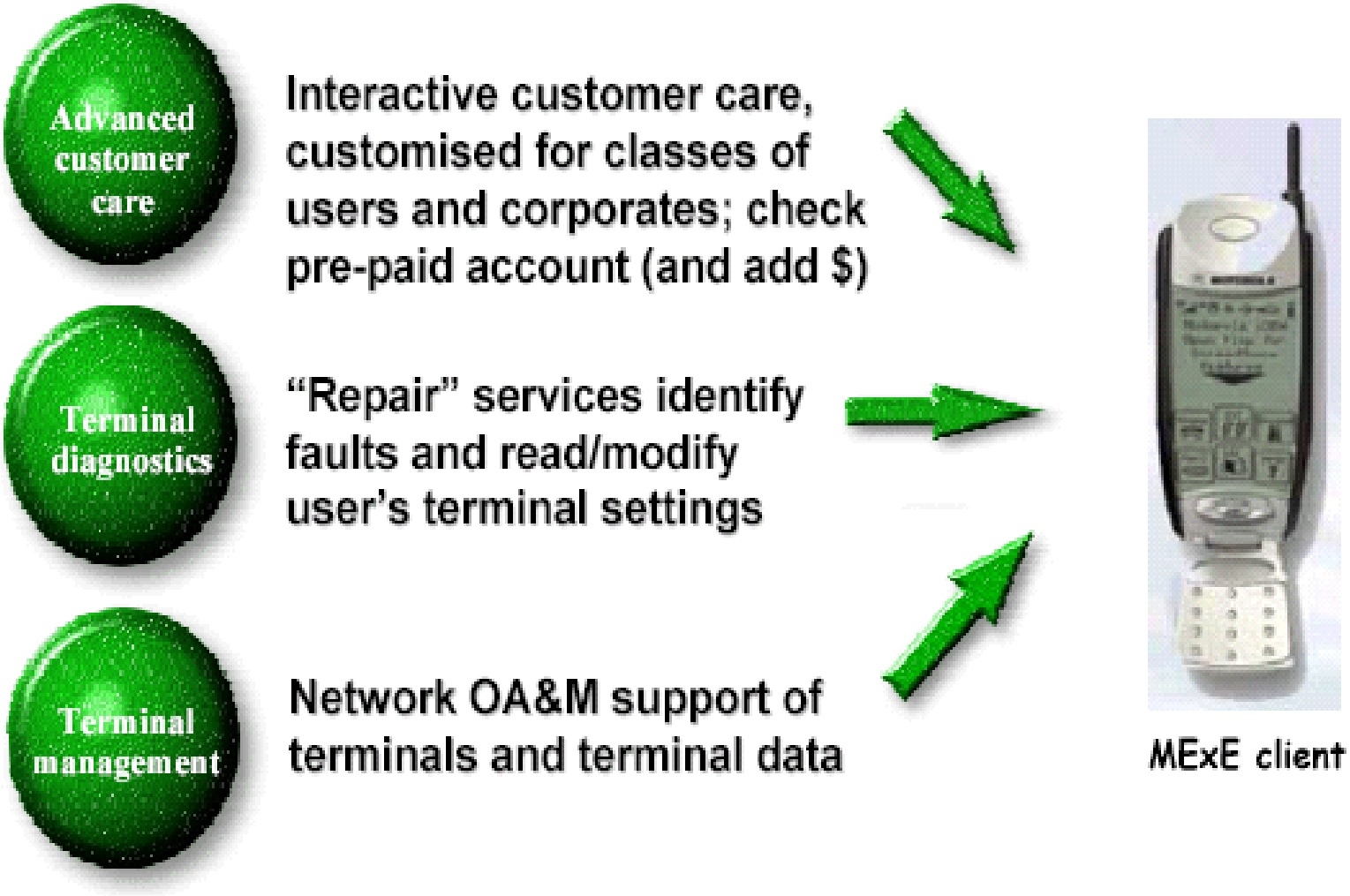
Example MExE Services

- access mechanisms to internet services



Example MExE Services

- Operator and terminal support services



Example MExE Services

- Commercial services and operator applications

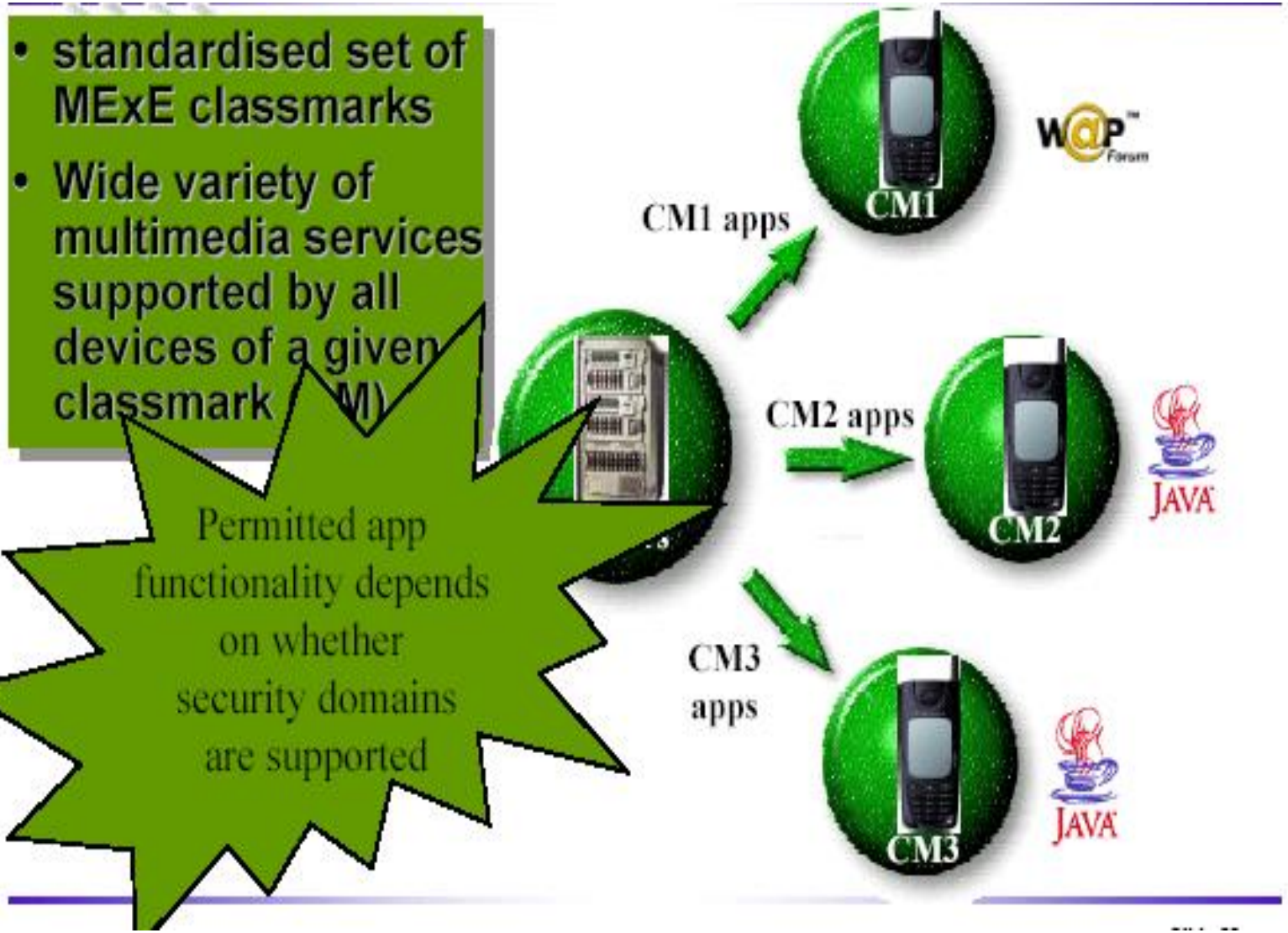
vending machines, travel and commuter signs/timetables, advertising billboards

personalised "Route Butler" traffic jam "Genie", automatic monitoring of car's systems, emergency calls, personalised car settings etc.

core software download; adopted by SDR Forum and supported by EU's projects

MExE client

MExE Functionality



MExE Functionality

- a more sophisticated user interface
  - advanced presentation
  - Graphical User Interface (GUI)
- security
  - supported by 3GPP TSG-S3 security committee
  - secure domains and “untrusted” domains (app functionality dependent on domain)
  - PKI security certificates
  - protection of user private data
  - controlled access to functionality
  - controlled access to network resources

MExE Functionality

- customisation and personalisation
  - services “look and feel” personalisation
  - user interface personalisation
  - services communication with network/non-network nodes
  - operator/content provider branding and differentiation
- user services management
  - services download
  - services/data management
  - determine active services

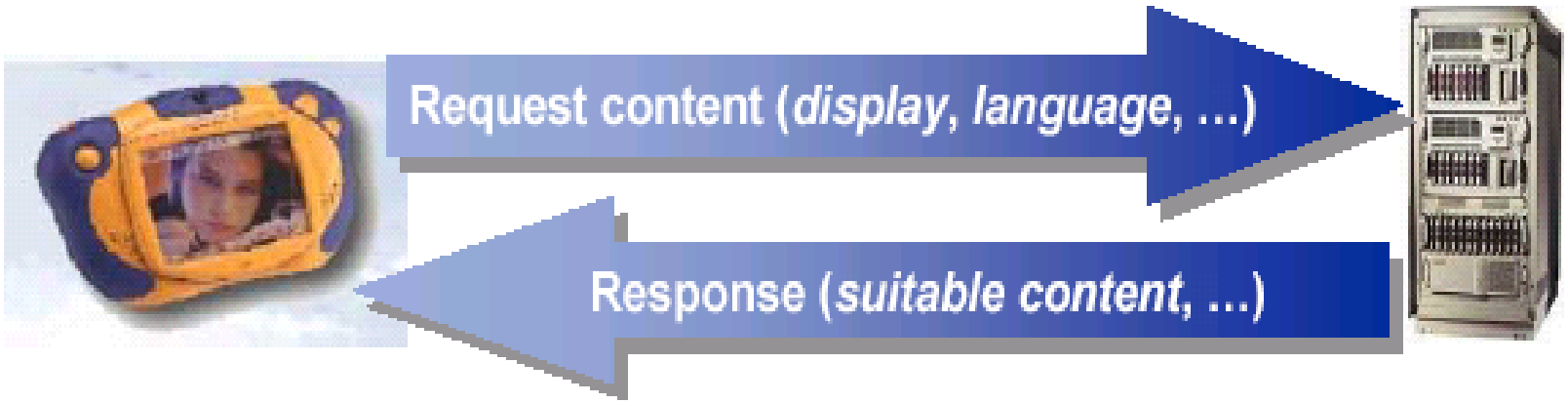
MExE Functionality

- re-use of existing technologies
  - IT and IP world expertise, services and development tools
  - WAP, Internet and Intranet
  - existing APIs, (i.e. WAP, PersonalJava, MIDP/CLDC Java...)

MExE does not create technology, but adds user and operator security onto leading edge world standards

MExE Functionality

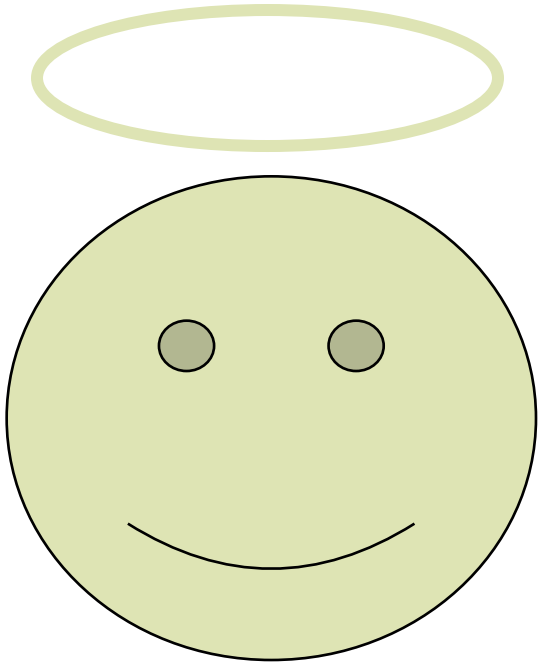
- capability negotiation
  - allows servers and MExE mobile phones to determine the most suitable content format for the device (e.g. depending on screen size, memory, colour capabilities etc.)



MExE Summary

- approved 3GPP standard
  - wireless technology agnostic, not just 3GPP
  - multi-environment: mobile, cordless, fixed
- enables unified multimedia services for mobile, cordless and fixed networks
- internet access, and internet multimedia services on mobile devices
- exploits IT/IP world expertise
  - IP-compatible, rapidly developed, low cost services
- supports authentication and security domains

Mobile services: what 3G has promised, 4G will deliver



Parlay/OSA:
an open API for service development

Outline

0- Introduction: the Parlay/OSA API: why, where, what?

1- A closer look at Parlay/OSA

- **Parlay/OSA Framework and Service Capability Features**
- **Parlay/OSA current functionality**

2- The Parlay/OSA Framework

- **Framework functionality**
- **How does it work?**

3- Example Parlay/OSA applications

Outline

4- Parlay/OSA standardisation
  - Bodies involved in Parlay/OSA standardisation
  - The Joint API Group
5- The next Parlay/OSA release
6- Summary, contacts

Outline

0- Introduction: the Parlay/OSA API: why, where, what?

1- A closer look at Parlay/OSA

2- The Parlay/OSA Framework

3- Example Parlay/OSA applications

4- Parlay/OSA standardisation

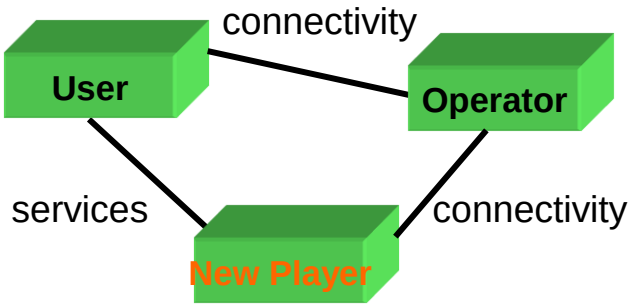
5- The next Parlay/OSA release

6- Summary, contacts

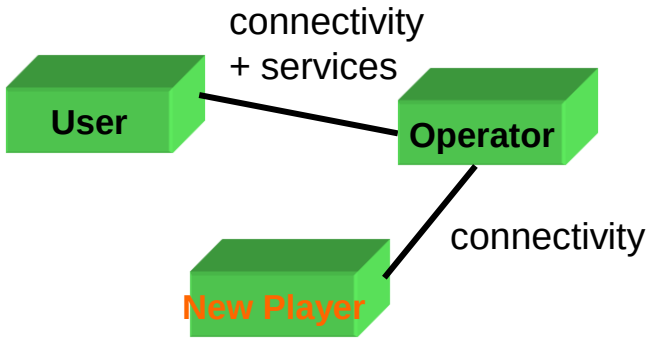
The Parlay/OSA API: Why? (1/2)

A change in business models has introduced new players in the telecom business

Some want to address users directly



Some prefer to do it via the Network Operator



But they have something in common:

They compete in the services market...

and they have **no network**!

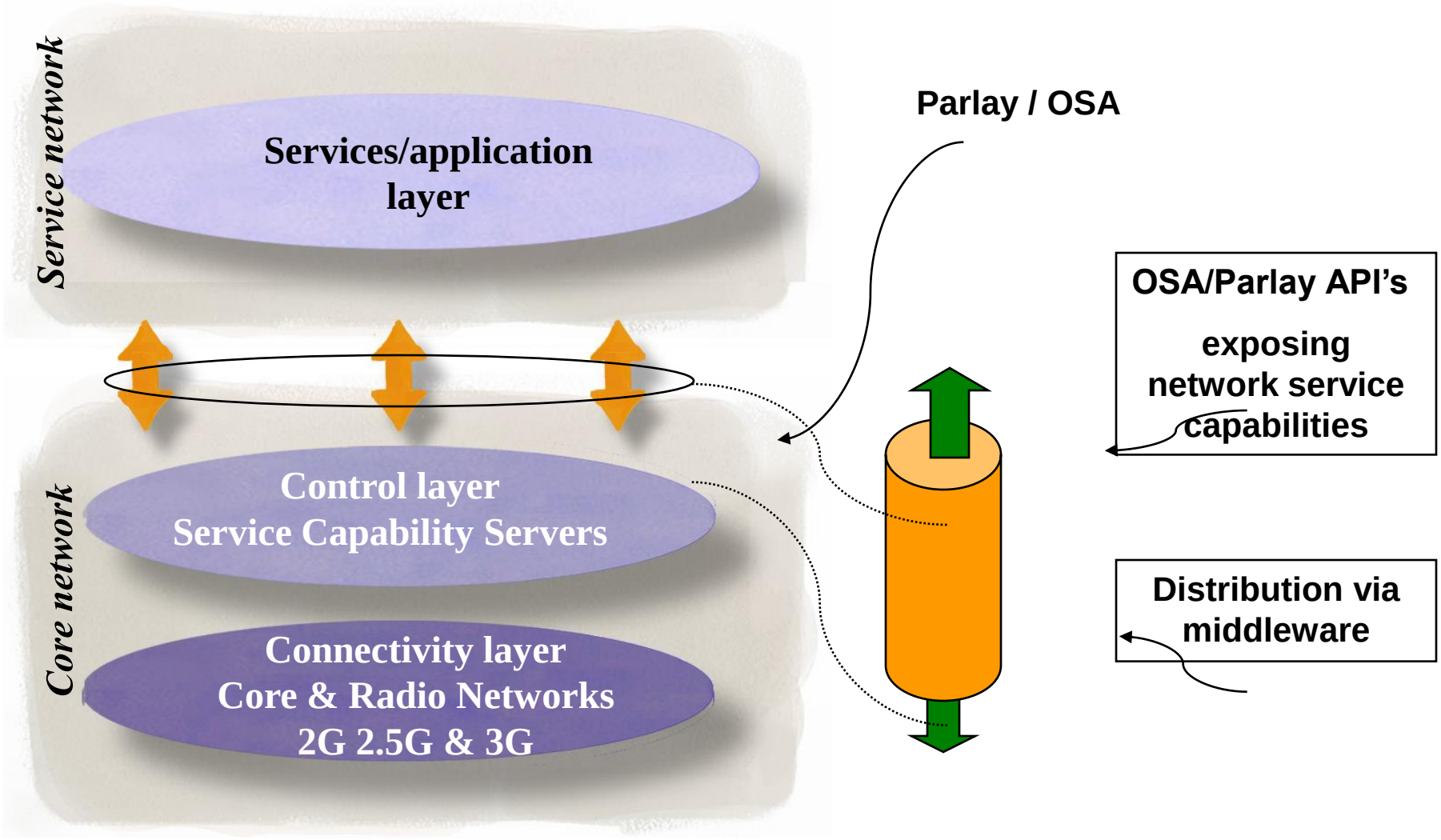
The Parlay/OSA API: Why? (2/2)

This is a win-win situation!

- It opens new sources of revenue for incumbent Network Operators
  - traffic in their networks increases
  - they may enrich their service offering
- It opens the telecom business to newcomers
  - VNOs, MVNOs, ASPs, ...

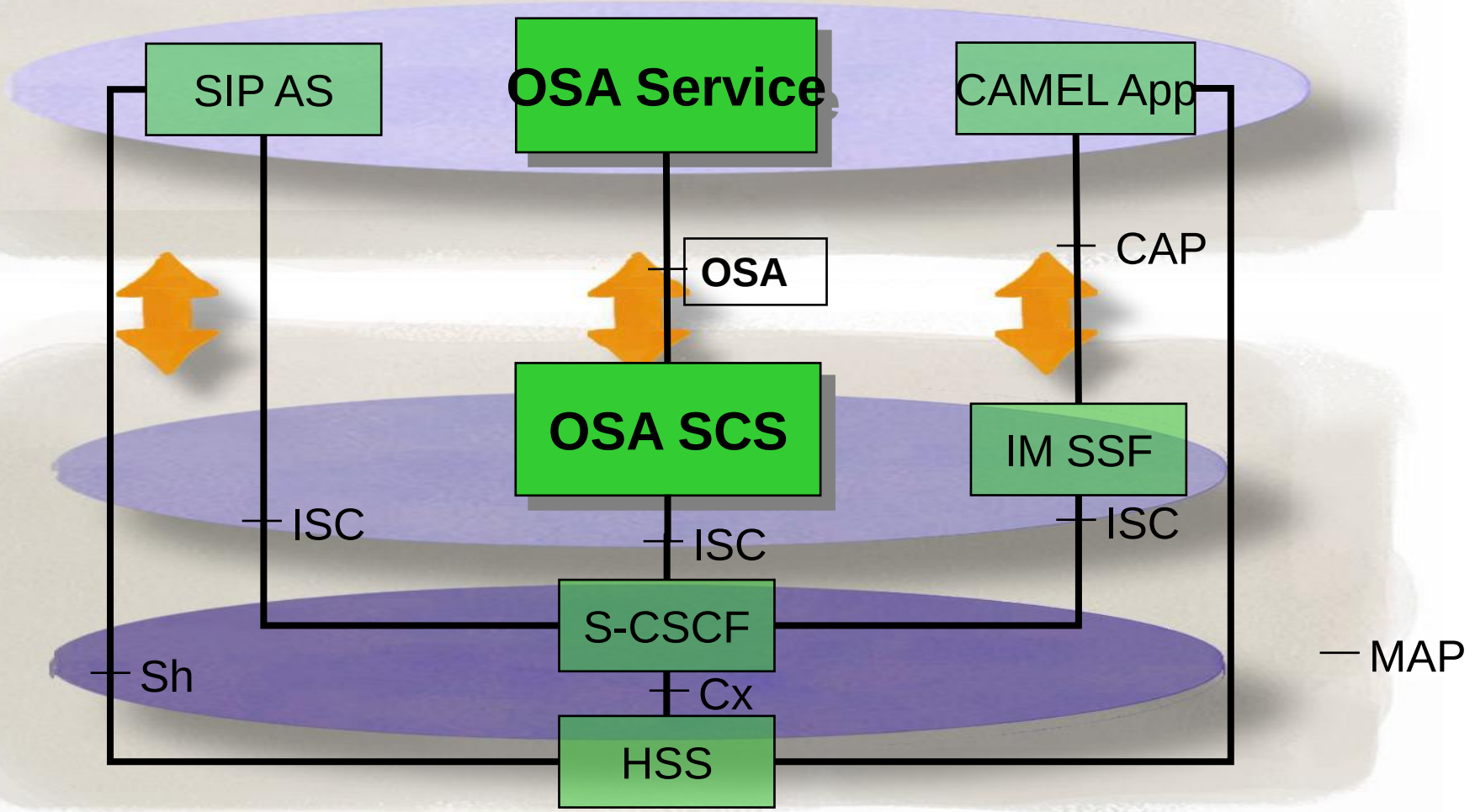
So we only need a technical enabler:

The Parlay/OSA API: Where? (1/2)



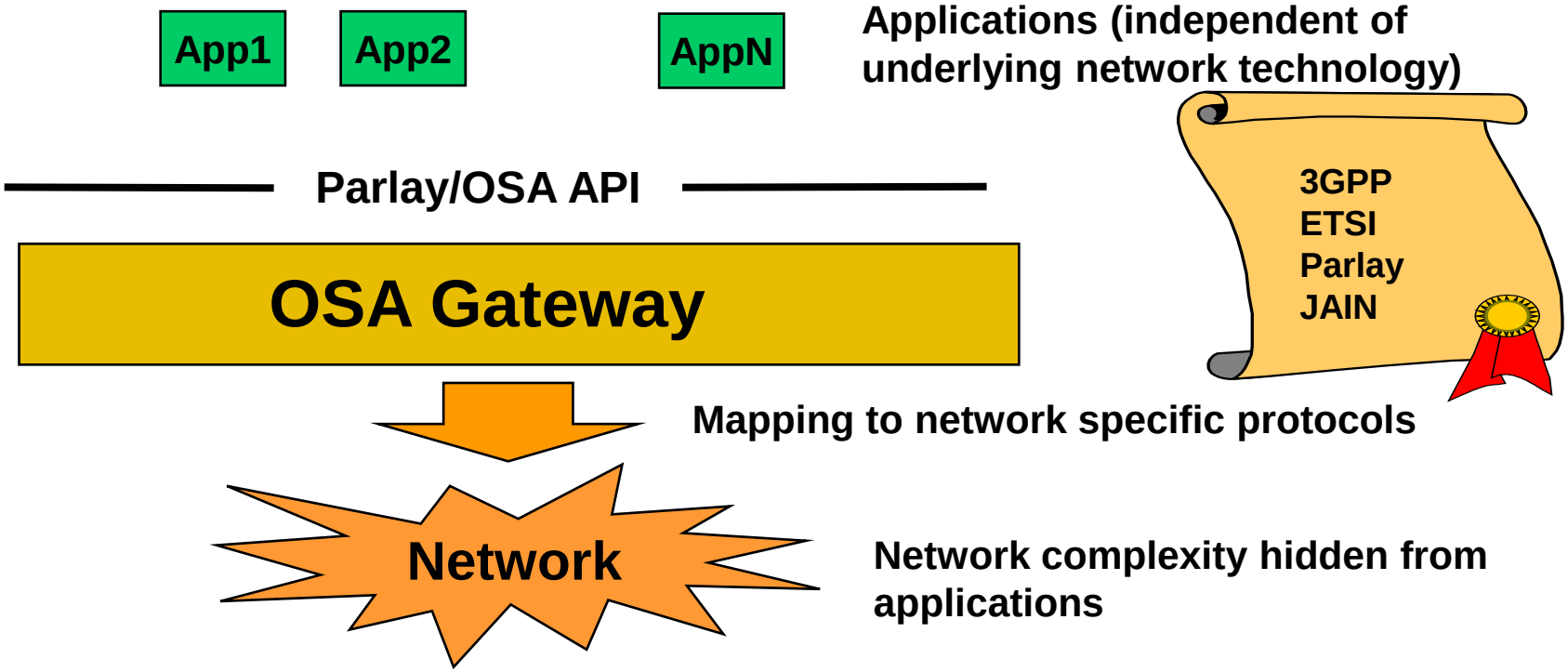
The Parlay/OSA API: Where? (2/2)

The UMTS Example



The Parlay/OSA API: What? (1/2)

Parlay/OSA (Open Service Access) is an API that enables operator and 3rd party applications to make use of network functionality through a set of open, standardised interfaces



The Parlay / OSA API: What (2/2)

Opening up of network by means of standardized APIs based on open technology. This leads to :

- Shorter TTM for applications / services due to abstraction and open technology (developer community orders of magnitude larger than telco developer community)
- Applications can also be developed and deployed by 3rd parties (creative, new innovative services).
- Applications can be network independent (multi-access / multi-service)
- Applications can be combination of
  - different capabilities
  - enterprise data with network functionality

  leading to new innovative services.

Combining Telecom & Datacom

The developer community is out there

Outline

0- Introduction

1- A closer look at Parlay/OSA

- **Parlay/OSA Framework and Service Capability Features**
- **Parlay/OSA current functionality**

2- The Parlay/OSA Framework

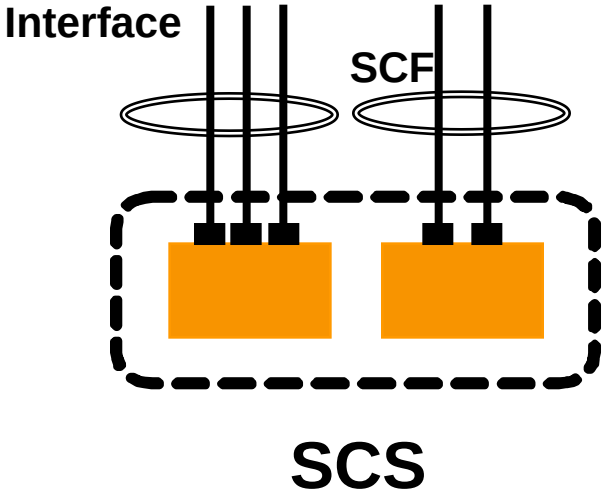
3- Example Parlay/OSA applications

4- Parlay/OSA standardisation

5- The next Parlay/OSA release

6- Summary, contacts

Parlay/OSA Terminology: SCSs and SCFs

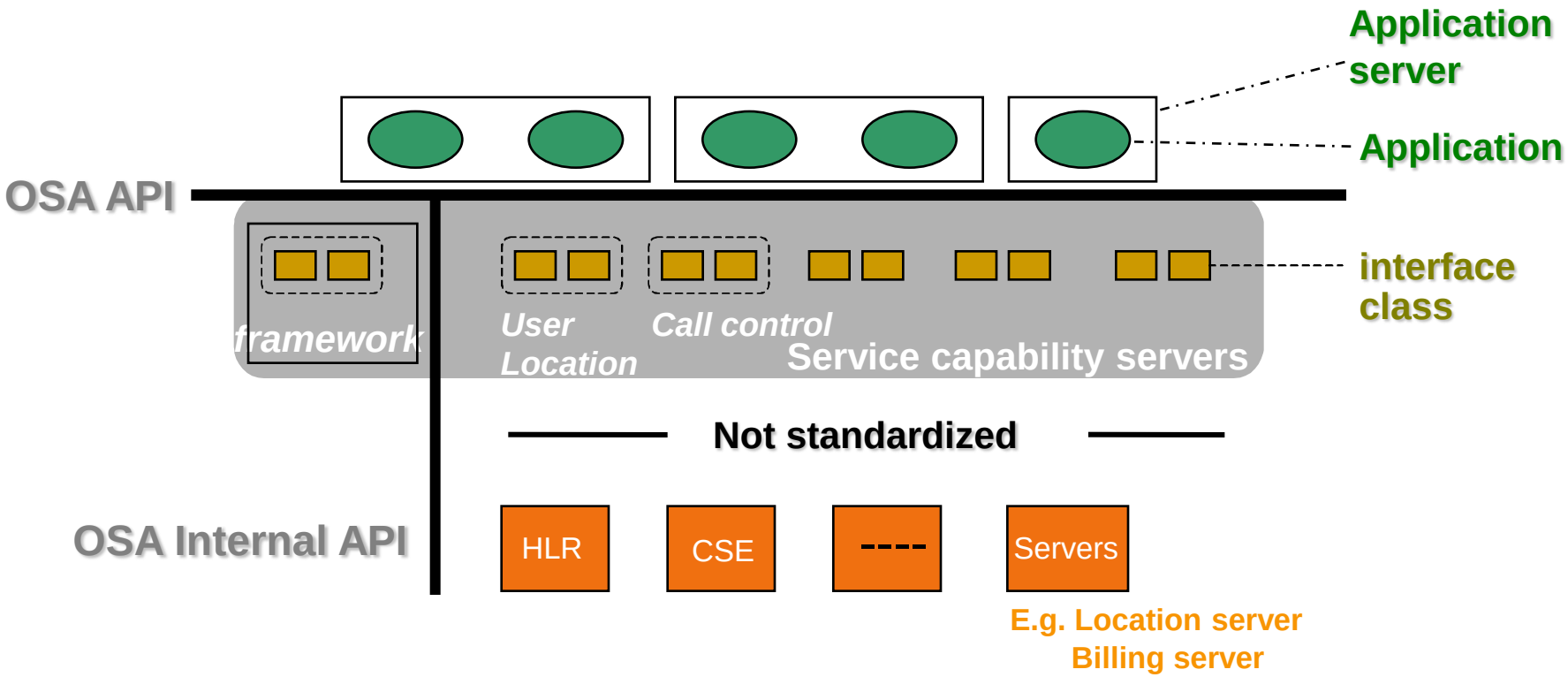


- The Parlay/OSA Gateway consists of several **Service Capability Servers (SCS)**: functional entities that provide Parlay/OSA interfaces towards applications.

- Each SCS is seen by applications as one or more **Service Capability Features (SCF)**: abstractions of the functionality offered by the network, accessible via the Parlay/OSA API. Sometimes they are also called **services**

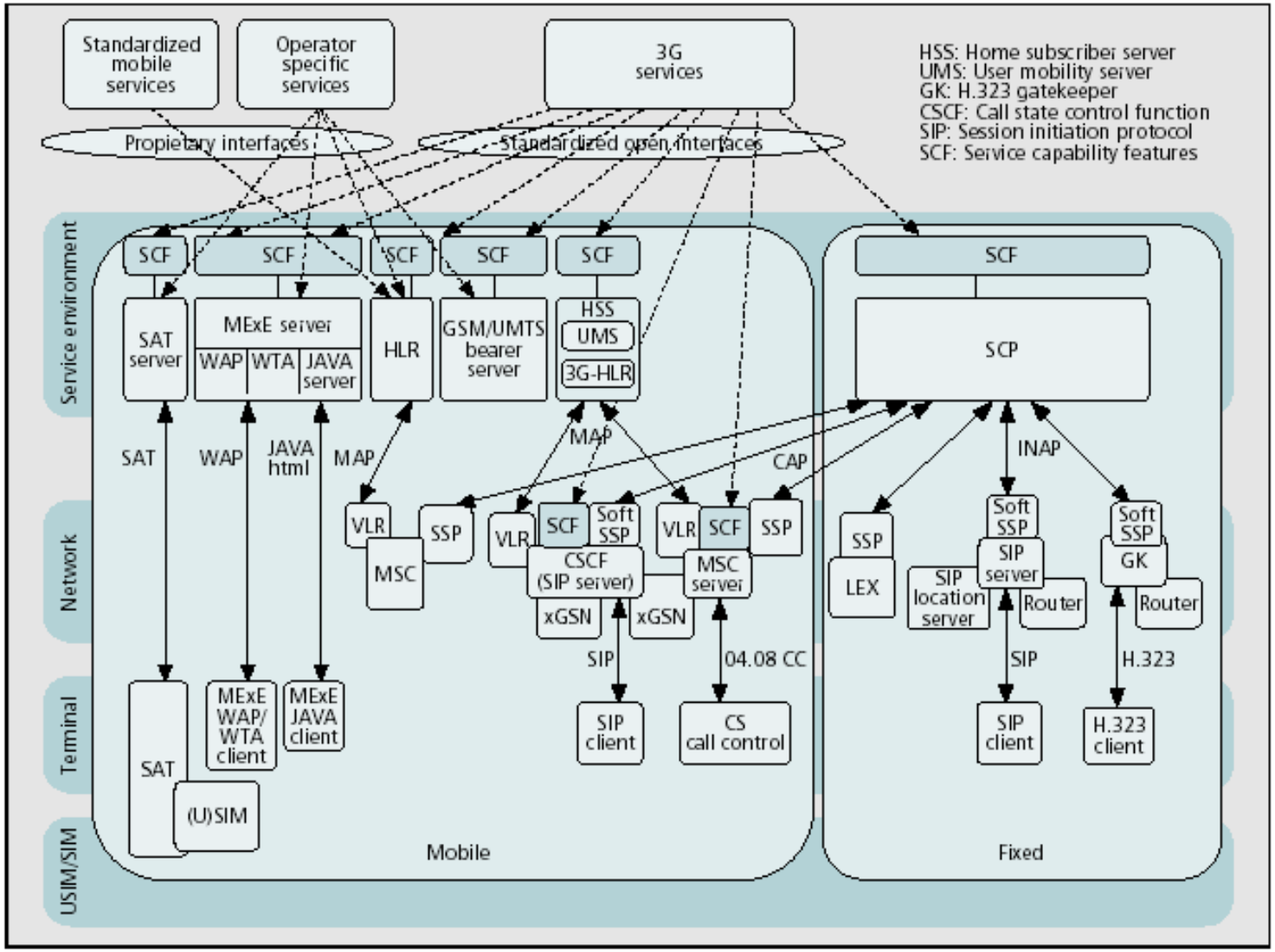
- The Parlay/OSA SCFs are specified in terms of interface classes and their methods

Parlay/OSA = Framework + A Set Of SCFs

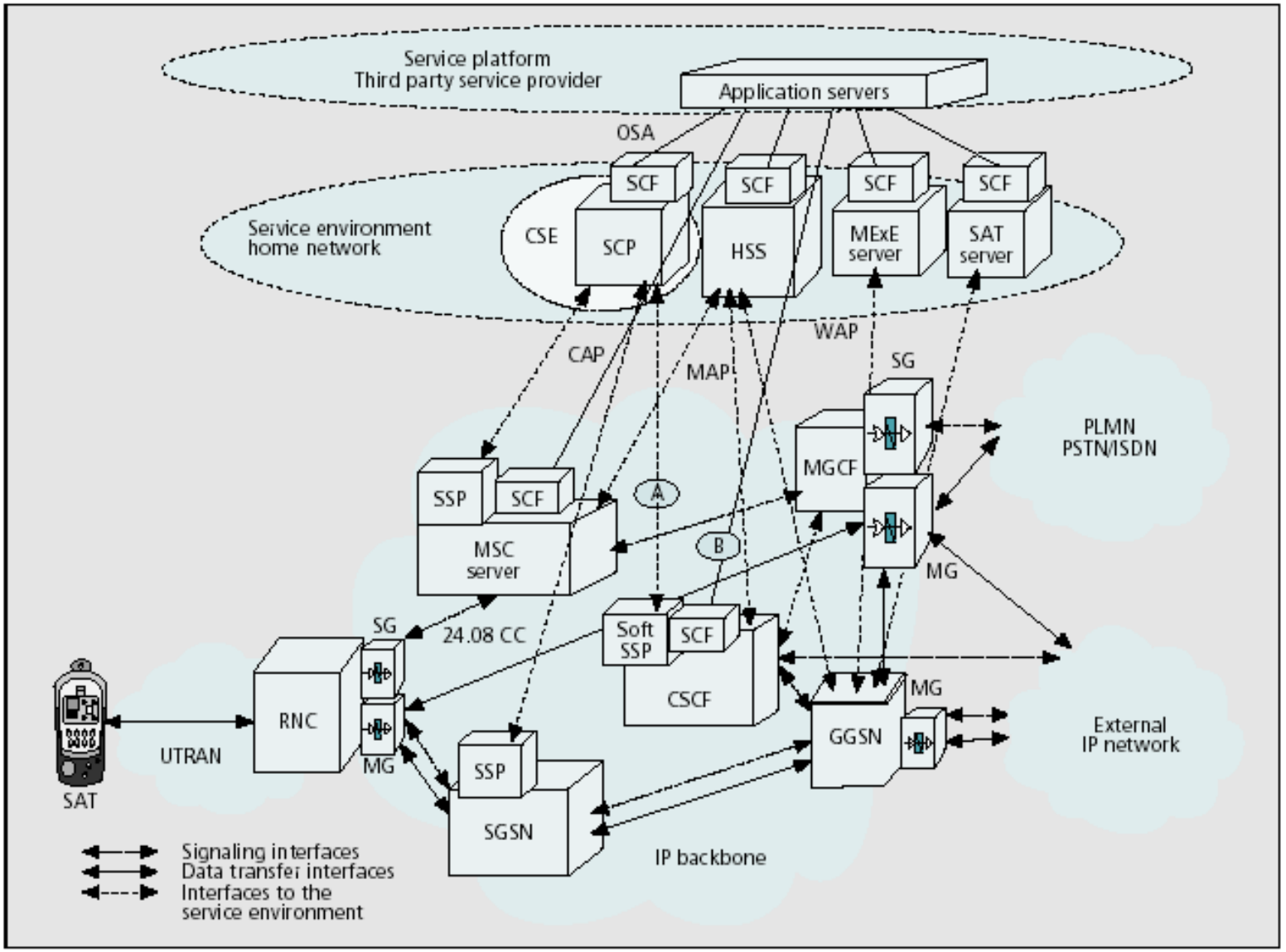


One of the Parlay/OSA SCSs is called the Parlay/OSA **Framework**, and is always present, one per network

UMTS Service Architecture



Mapping of SCFs to Release 2000 Network Architecture



Outline

0- Introduction

1- A closer look at Parlay/OSA

- **Parlay/OSA Framework and Service Capability Features**
- **Parlay/OSA current functionality**

2- The Parlay/OSA Framework

3- Example Parlay/OSA applications

4- Parlay/OSA standardisation

5- The next Parlay/OSA release

6- Summary, contacts

Basic Parlay/OSA SCFs

Call Control	**The Call Control family, with capabilities ranging from setting up basic calls to manipulating multimedia conference calls (see Note 1)**
User Interaction	**Obtain information from the end-user, play announcements, send short text messages, etc**
User location / User status	**Obtain location and status information**
Terminal capabilities	**Obtain the capabilities of an end-user terminal**
Data session control	**Control of data sessions**
Generic Messaging	**Access to mailboxes (see Note 2)**
Connectivity Management	**Provisioned QoS (see Note 2)**
Account Management	**Access end-user accounts**
Content based Charging	**Charge end-users for use of applications / data**

Note 1: Multimedia and Conference Call Control not part of 3GPP OSA Release 4
Note 2: Not part of 3GPP OSA Release 4

Outline

0- Introduction

1- A closer look at Parlay/OSA

2- The Parlay/OSA Framework

- **Framework functionality**
- **How does it work?**

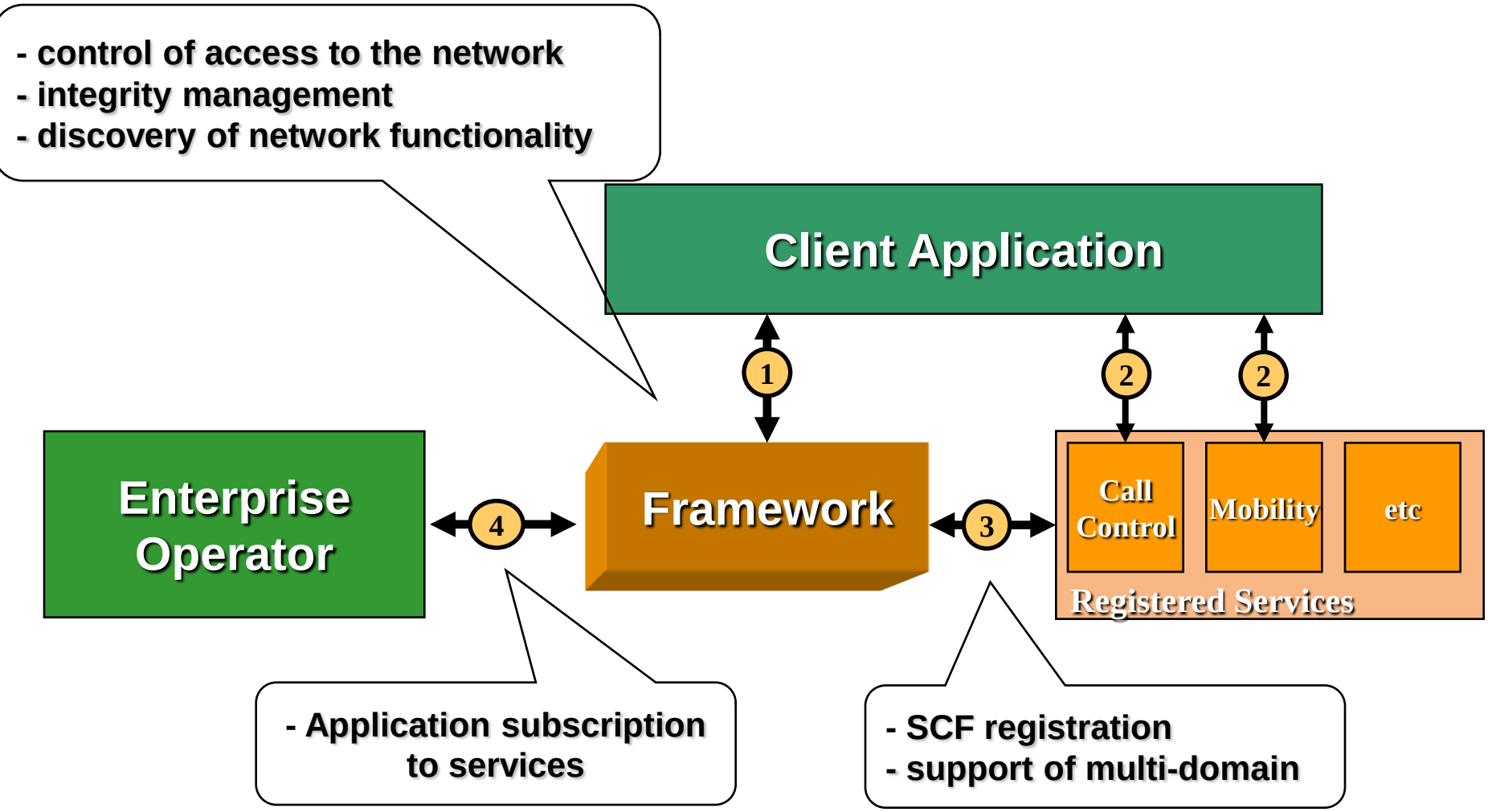
3- Example Parlay/OSA applications

4- Parlay/OSA standardisation

5- The next Parlay/OSA release

6- Summary, contacts

The Parlay/OSA Framework



Outline

0- Introduction

1- A closer look at Parlay/OSA

2- The Parlay/OSA Framework

- **Framework functionality**
- **How does it work?**

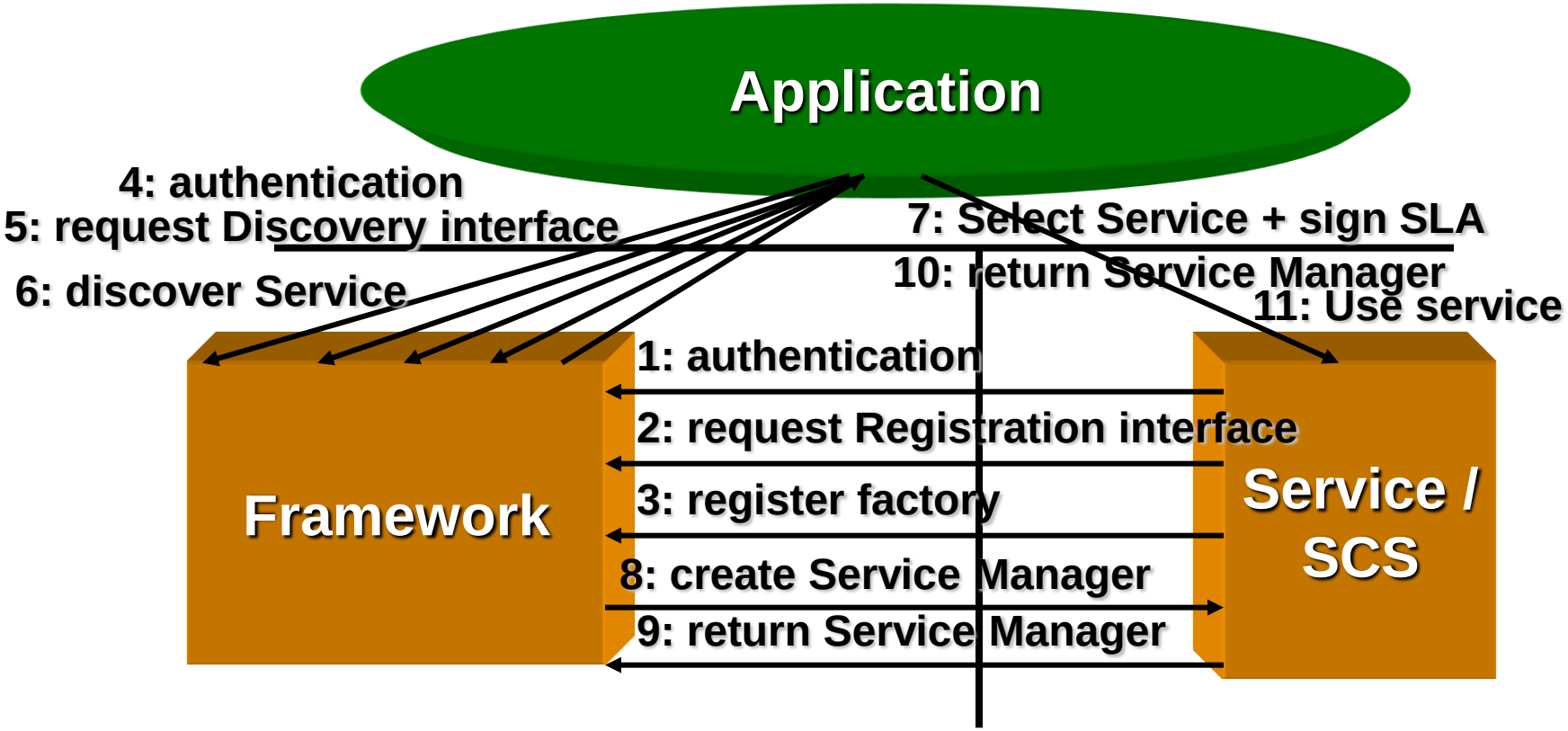
3- Example Parlay/OSA applications

4- Parlay/OSA standardisation

5- The next Parlay/OSA release

6- Summary, contacts

How does the FW work ?



Outline

0- Introduction

1- A closer look at Parlay/OSA

2- The Parlay/OSA Framework

- **Framework functionality**
- **How does it work?**

3- Example Parlay/OSA applications

4- Parlay/OSA standardisation

5- The next Parlay/OSA release

6- Summary, contacts

Information Application

The user dials in to the application to access information,

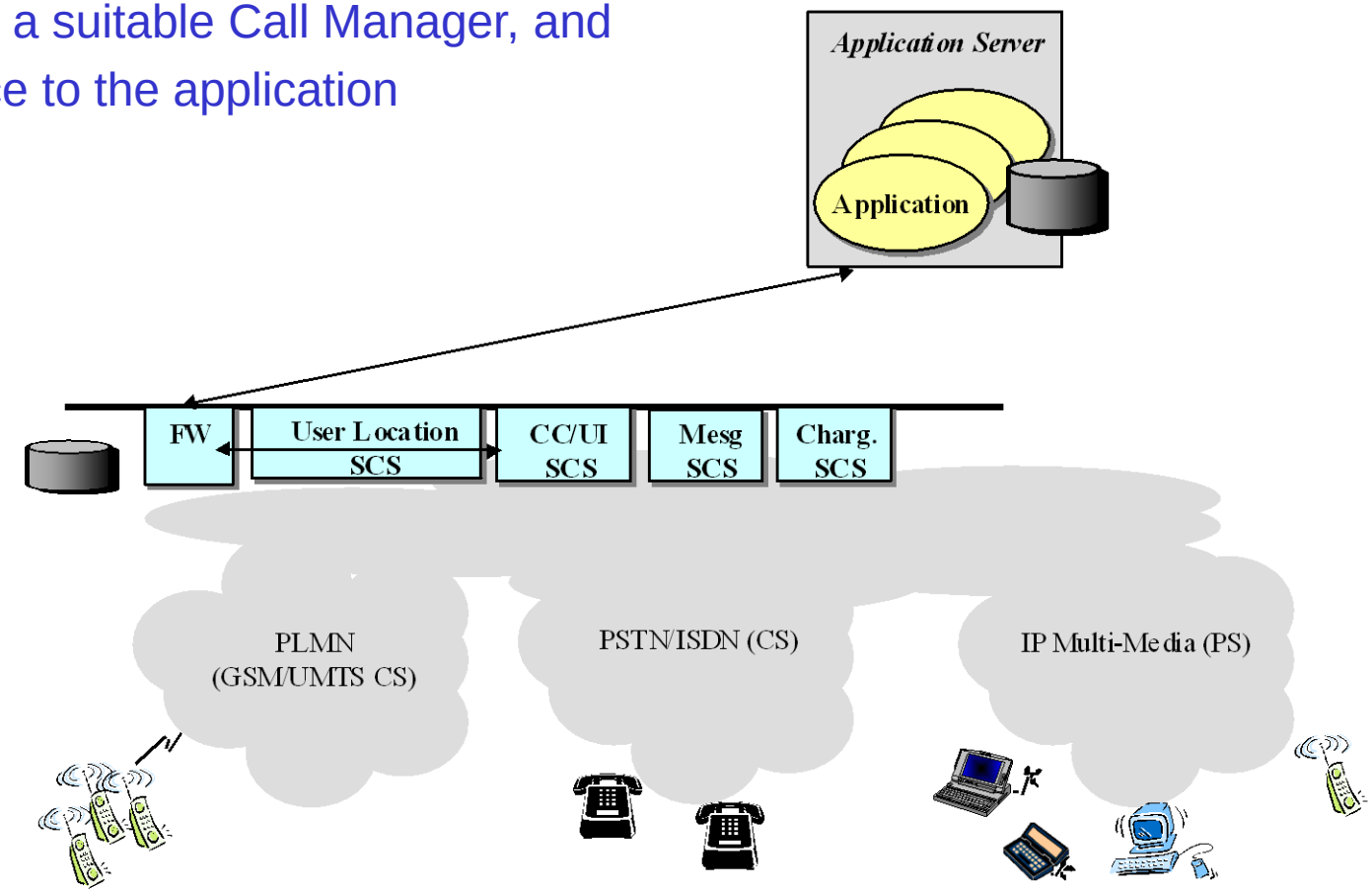
- traffic
- weather,
- stocks,
- etc

via voice.

Information Application : interaction flow before traffic

The Application registers to the Framework

The Framework starts a suitable Call Manager, and passes a reference to the application



Information Application : interaction flow during traffic

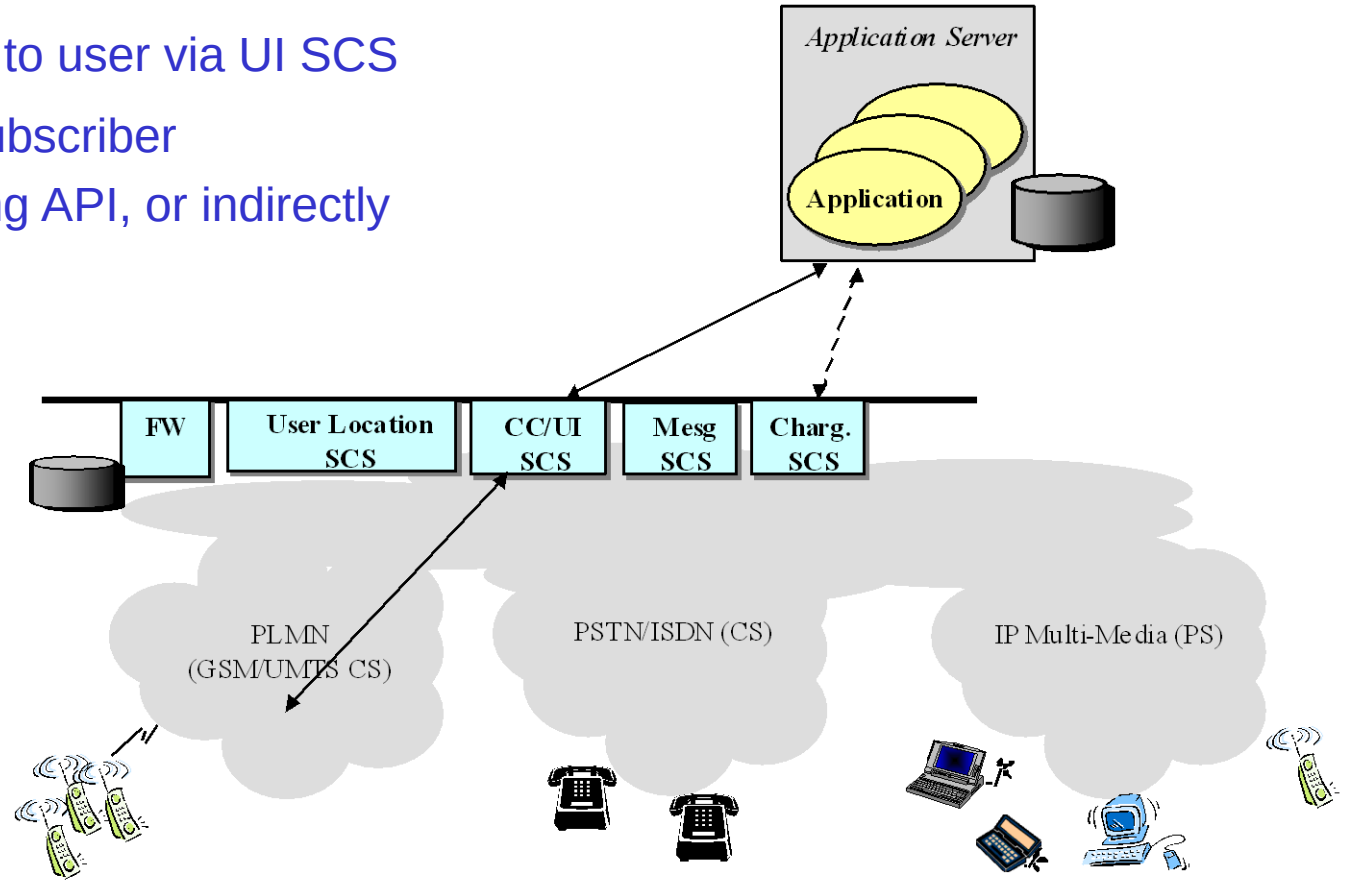
User calls service number

SCS checks subscription to service

Information presented to user via UI SCS

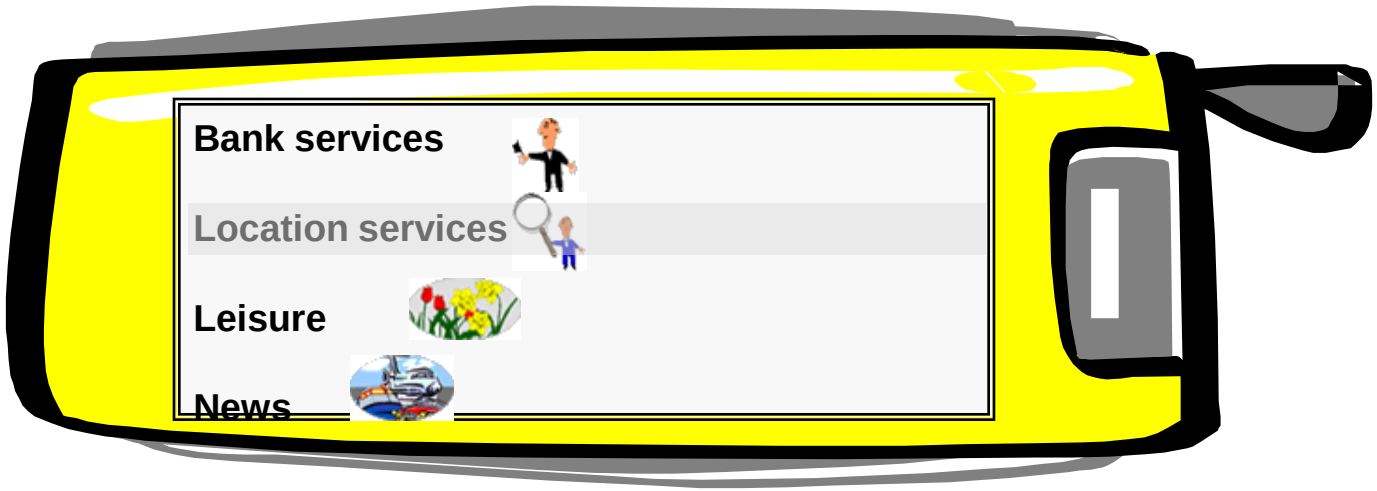
Application charges subscriber

(either via Charging API, or indirectly via CC API)



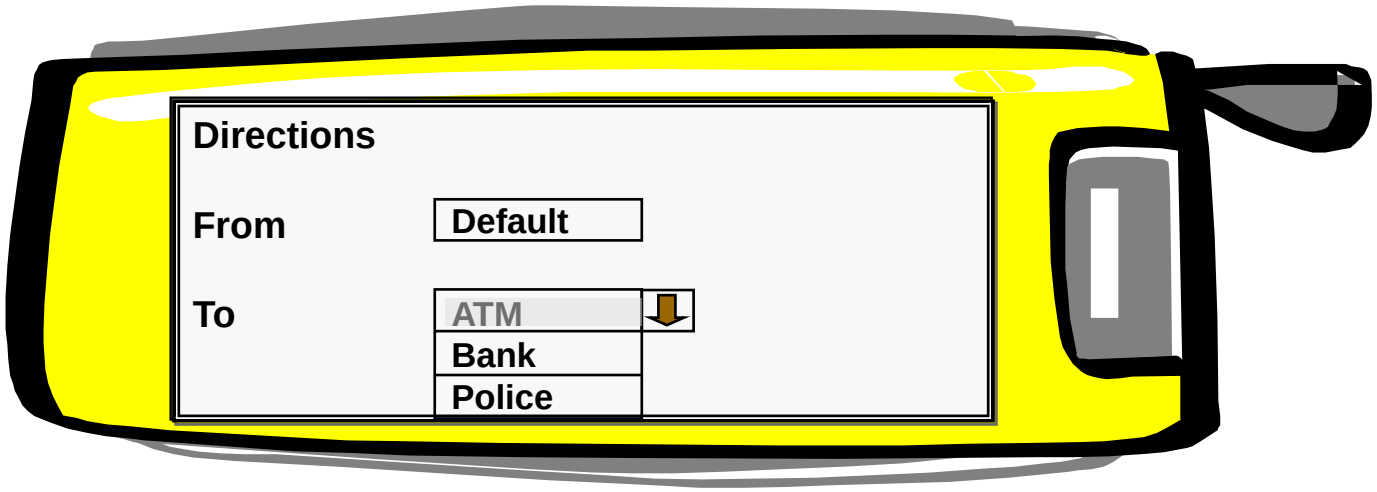
Location Service

This is an example of combination of enterprise data with network capabilities

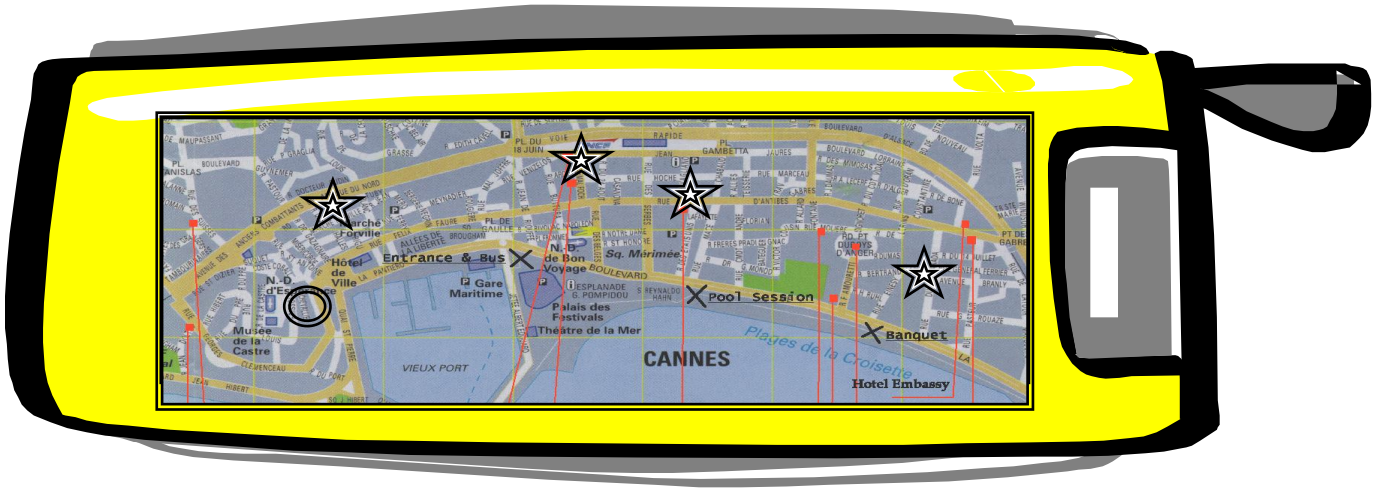


Location Service

The idea is that the user is able to find out the nearest ATM machine



Location service

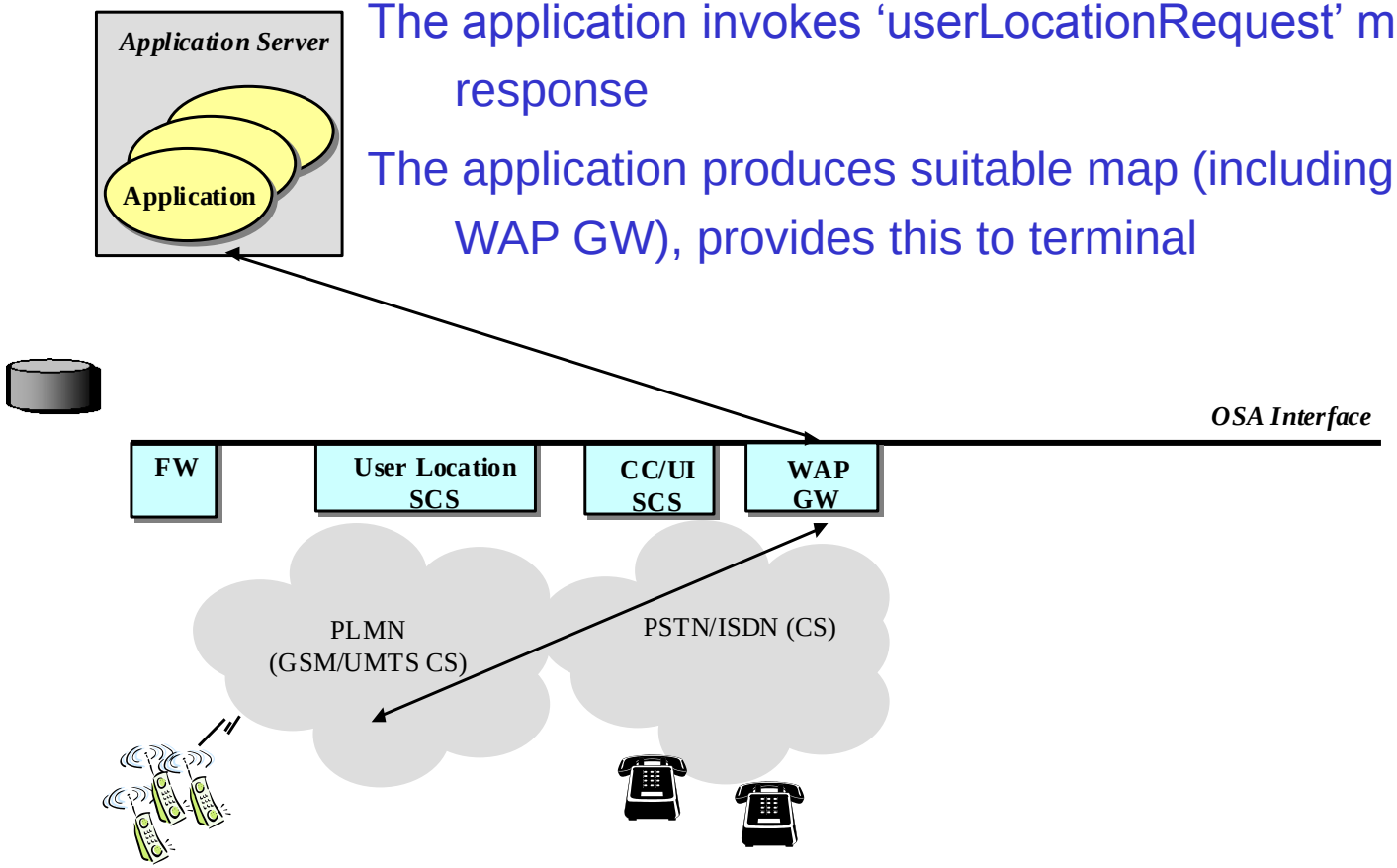


Location service: interaction flow during traffic

The terminal interacts via WAP with application, selects ATM location option

The application invokes ‘userLocationRequest’ method, gets response

The application produces suitable map (including term.caps from WAP GW), provides this to terminal



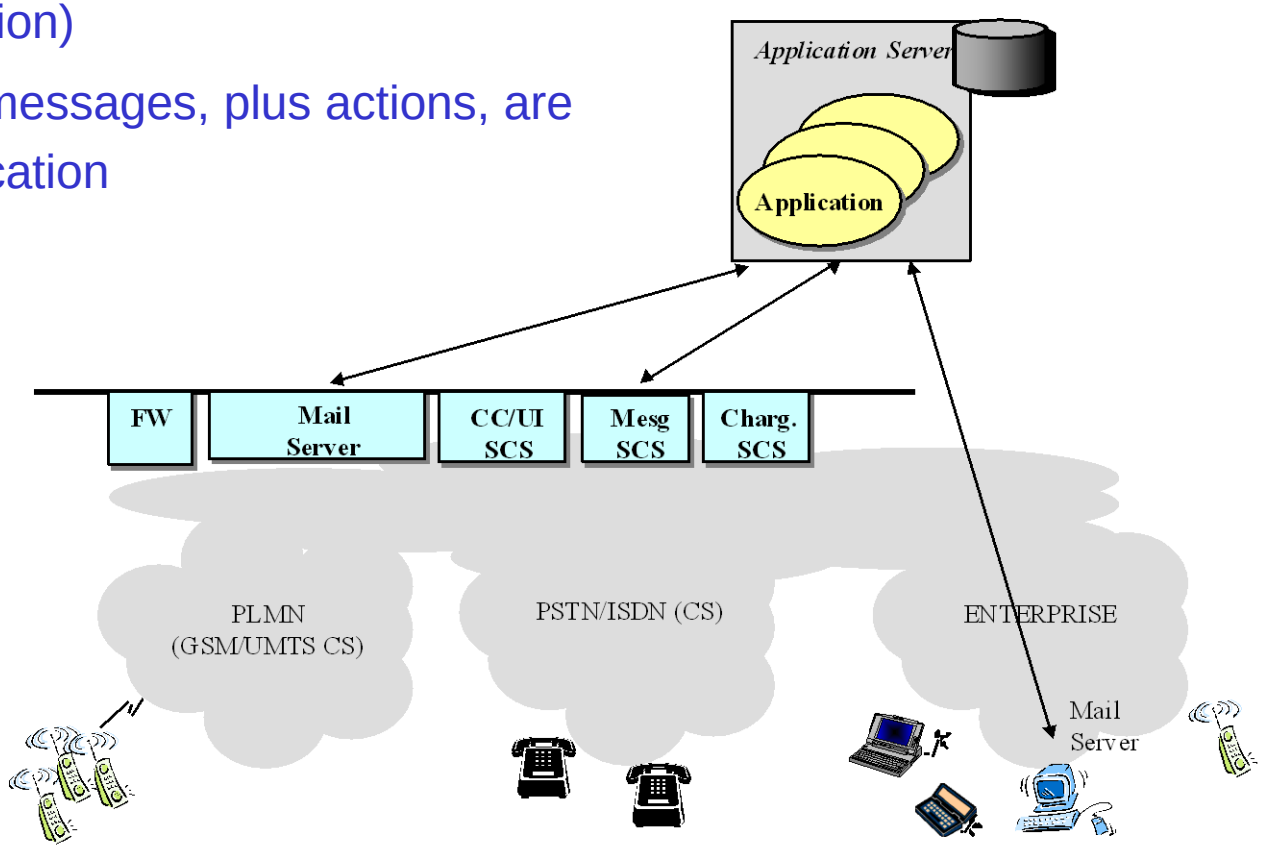
Unified messaging application

The application allows user to access all his messages. This is an example of combination of information in different business domains

Unified messaging application: interaction flow

The user sets messaging preferences (private and corporate combined if desired) via Web/WAP (or via voice recognition)

Notifications of different messages, plus actions, are handled by the application



Outline

0- Introduction

1- A closer look at OSA

2- The Parlay/OSA Framework

3- Example Parlay/OSA applications

4- Parlay/OSA standardisation

- **Bodies involved in Parlay/OSA standardisation**
- **The Joint API Group**

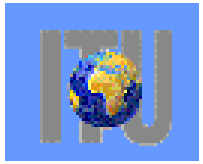
5- The next Parlay/OSA release

6- Summary, contacts

Bodies Involved In Parlay/OSA Standardisation

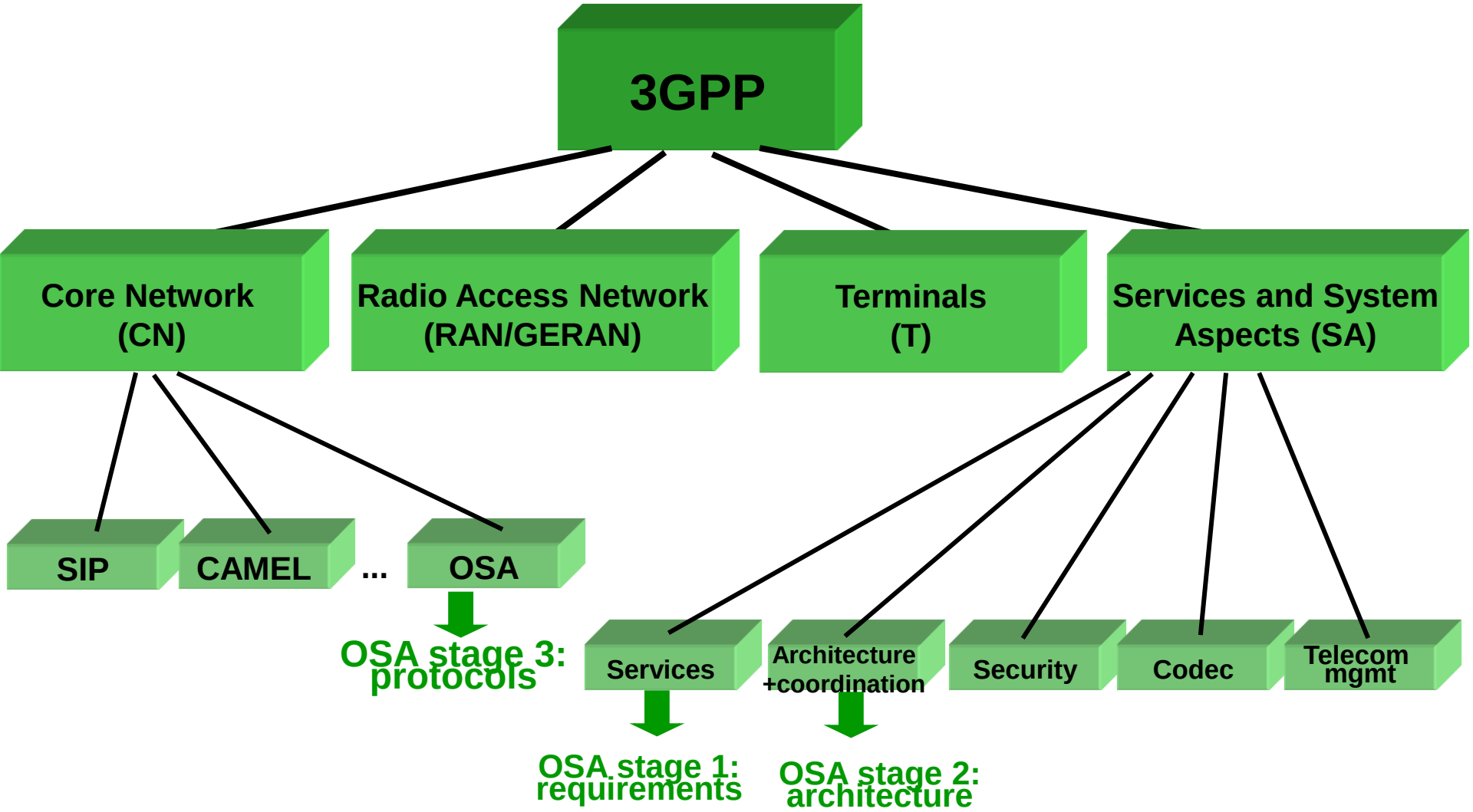
OSA specification and standardisation is a joint effort by the following bodies:

- 3GPP CN5
- ETSI SPAN12
- ITU-T SG11 (only ref. document)
- The Parlay Group



The objective is to have a single API for the whole developer community

OSA (Parlay) In 3GPP



OSA (Parlay) In ETSI

- ETSI SPAN (*Services and Protocols for Advanced Networks*) was re-organized
- The group ETSI SPAN12, *Application interfaces for service providers and network operators*, was created
- An activity in ETSI SPAN14, called *Service Provider Access Requirements (SPAR)*, was also created
- ETSI SPAN12, aware of the identical scope of the work in 3GPP CN5, agreed to work jointly and make all meetings joint meetings
- Today ETSI SPAN12 has an OSA Project, part of the Joint API Group and working also on OSA/Parlay Compliance

OSA/Parlay In ITU-T

- ITU-T SG11 has defined a Question 4 called API/Object interface and architecture for signaling, "covering the interface between network control and application layers"
- ITU-T has decided to write a reference document for this activity, and delegate the contents to other bodies
- This way ITU-T will adopt OSA specifications by ETSI (+3GPP +Parlay)
- ITU-T SG11 draft document is called TD 1/11-25

Parlay (OSA) In The Parlay Group

- The Parlay Group (www.parlay.org) started in March 98, and today is an open, multi-vendor forum with around 50 members from the IT and Telecom business
- The Parlay Group aims to create open, technology independent APIs which enable developing applications across multiple networks (=OSA!); and to accelerate the adoption of these APIs and promotes their use and standardisation.
- Technical work in the Parlay Group is done in Work Groups; the Parlay WGs have joined the 3GPP+ETSI OSA (Parlay) joint group to develop together a single API

Outline

0- Introduction

1- A closer look at Parlay/OSA

2- The Parlay/OSA Framework

3- Example Parlay/OSA applications

4- Parlay/OSA standardisation

- **Bodies involved in Parlay/OSA standardisation**
- **The Joint API Group**

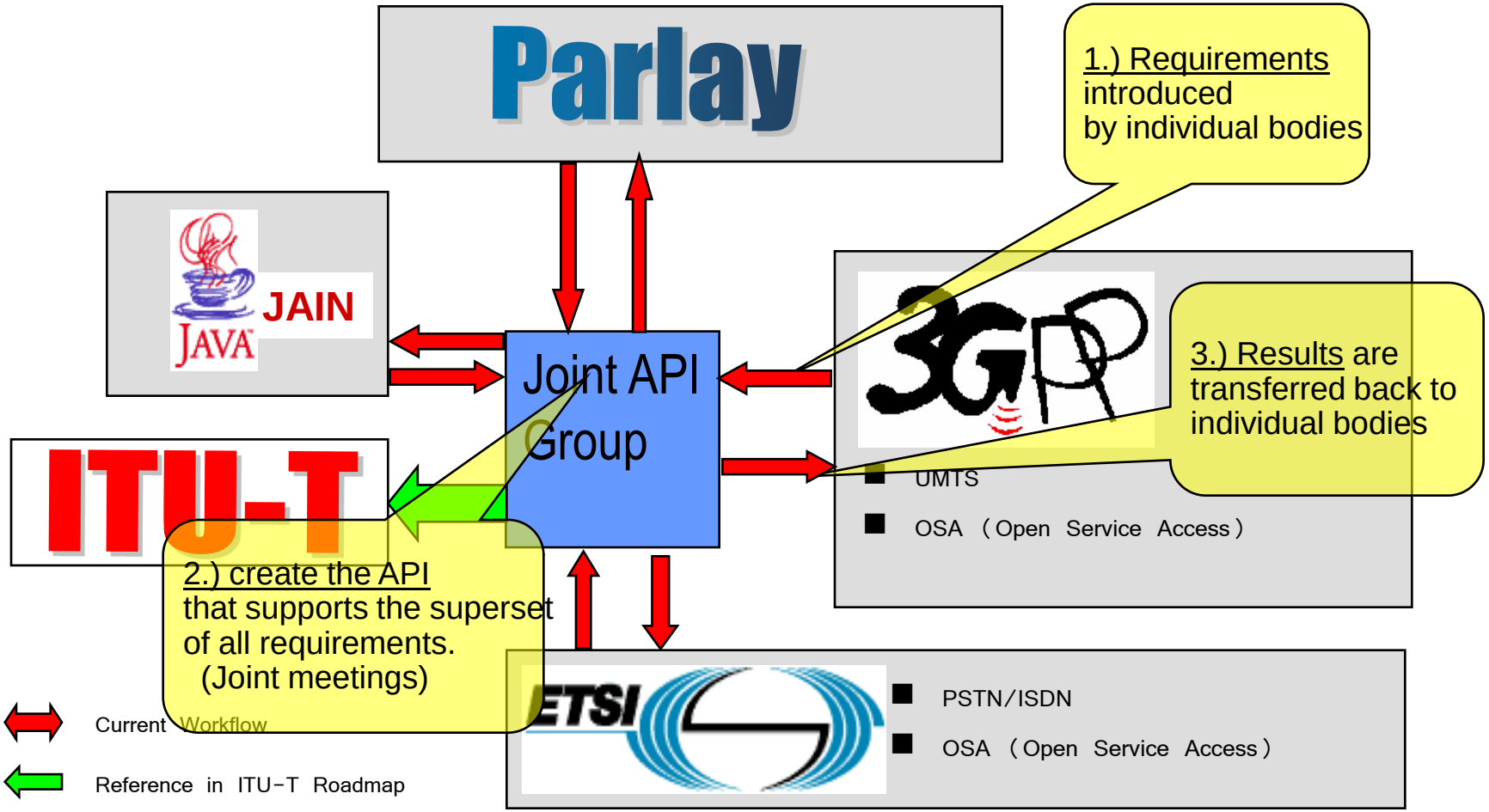
5- The next Parlay/OSA release

6- Summary, contacts

Today's Parlay/OSA Joint Activities

- **Today 3GPP, ETSI and Parlay have joined forces to specify a single API for the whole developer community**
- **Requirements coming from the three participating bodies are taken into account:**
  - 3GPP requirements from SA1 and SA2
  - ETSI requirements from SPAN14 SPAR
  - Parlay requirements from the Parlay Group
- **All meetings are joint meetings**
- **The joint work is (UML) based on a common model, http://docbox.etsi.org/tech-org/span/open/span12/UML/ Then each body generates its own document format**

API's for Open Service Access; ONE API for ONE developer community



Alignment and backwards compatibility

- The current last versions of the three bodies are fully aligned

  3GPP Rel4 ⇨ ETSI Ver1 ⇨ Parlay 3

- None of them is backwards compatible with any of its previous releases/versions, due to changes based on feedback from implementers
- From now on backwards compatibility is a must

3GPP Parlay/OSA Rel4 Document Structure (1/2)

The Parlay/OSA API is contained in two sets of documents:

- **The API specification in terms of interfaces and their parameters (UML description and IDL specification), sequence diagrams and state models**
- **The Mapping specification of the Parlay/OSA API and network protocols : a possible, informative mapping from the API to various network protocols (i.e. MAP, CAP,..)**

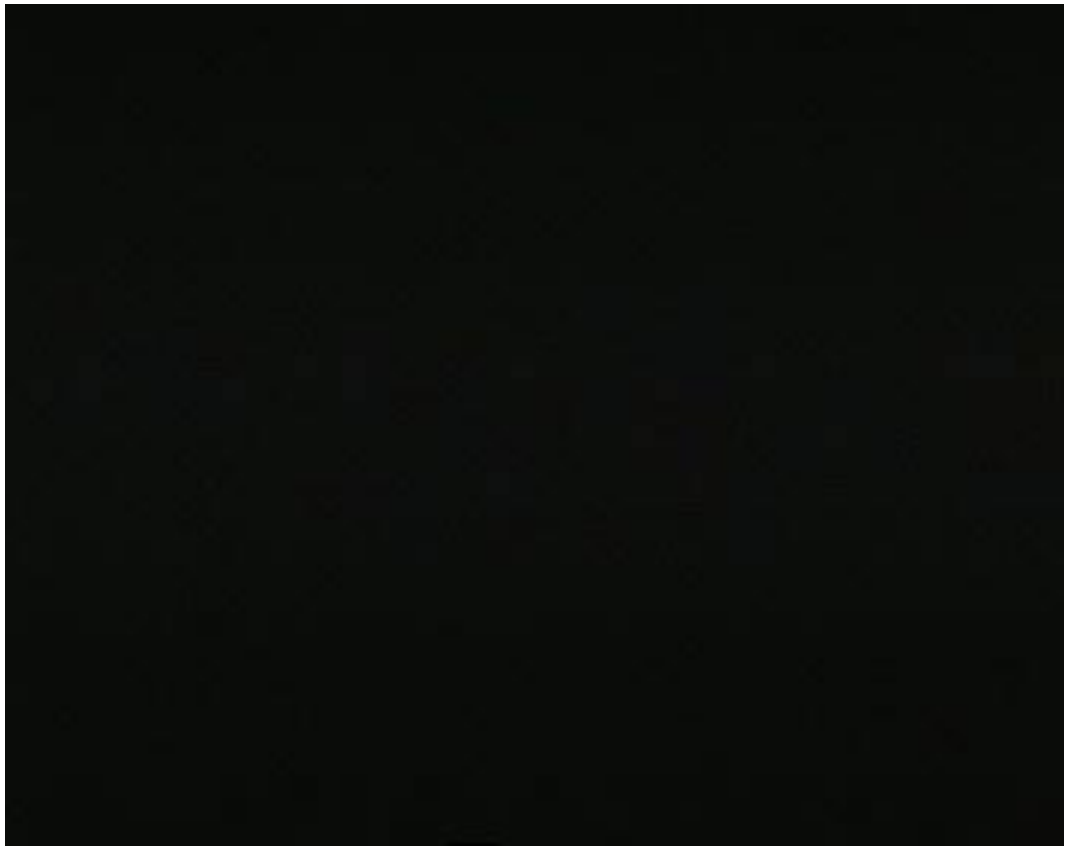
Parlay/OSA Document Structure (2/2)

The specification is in turn contained in the following documents:

- 3GPP : TS 29.198 /12 parts (API) + TR 29.998 (Mapping)
http://www.3gpp.org/ftp/Specs/2001-12/Rel4/29_Series
- ETSI : ES 201 915 (API) + TR 101 917 (Mapping)
http://docbox.etsi.org/tech-org/span/Open/Span12/osa.html
- Parlay
http://www.parlay.org/specs/index.asp

Choose your favorite: all are aligned!

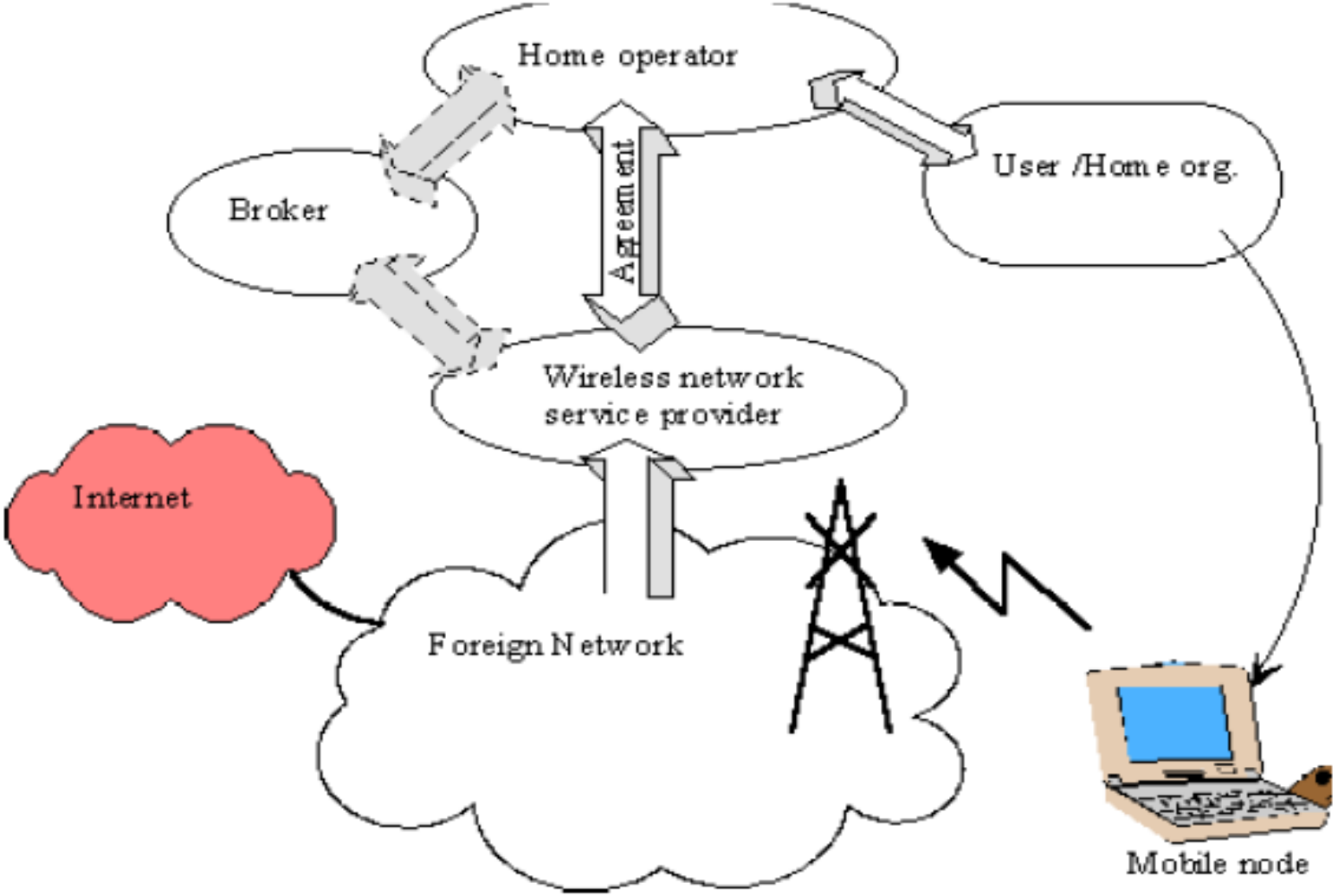
Παροχή προηγμένων υπηρεσιών οποτεδήποτε και οπουδήποτε



VTT

Business modelling and charging aspects

4G Business model



4G simple business scenario

User has an agreement with the home operator that he can get access to foreign networks.

Home operator has agreements with wireless network service providers. They could have been made directly or by using **broker**'s services.

Wireless network service provider has bought foreign networks bandwidth and provides the wireless Internet connection service to the user.

Various roles in the business model

Home operators

The user needs somebody, called a home operator, to secure him access to foreign networks.

To answer to these expectations, the home operator tries to make agreements with as many foreign networks and foreign service providers as possible. A home operator could also choose an easier way – to find a broker holding agreements with foreign service providers and networks.

Home operators are mostly going to be big companies as the customers are going to valuate them on the basis how many wireless network service providers they have agreements with. Its not the number that counts but the area covered. The key question will be, which operator covers the area where a specific customer is used to walking around.

Smaller companies that want to act as home operators are forced to find “umbrella operator(s)” for themselves in order to stay in competition. In reality, this means signing a contract with a big operator in order to use his agreements. This way, the home operators are going to build up a hierarchical chain. Probably this is not going to be a high one. As it was described before, it’s easier for big companies to survive. Three levels would be quite suitable. A small company makes first an agreement, for example, with a country-level operator that, in its turn, cooperates with an international operator.

The home operator may (but does not have to) own a network. This way it could act as a foreign service provider at the same time.

Various roles in the business model

ISP – Internet Service Providers

- Experience of E-commerce and advertising
  - In the future, there will be a substantial amount of subscribed advertising. It means that you can for example ask to send you every Friday and Saturday evening at 7o'clock information about live bands in Helsinki bars. As the bars are paying for the information to be advertised, this means cheaper service to the customers. So experience in advertising will be very relevant.
- Fixed Internet portal experience
  - They have the knowledge of what people are doing in the Internet. (For example, what services they prefer, which web sites they visit, etc.) It could help in attracting customers.
- Strong brand
  - ISPs' biggest strength is that they already have strong brands. Life has shown that people always prefer a name known to them, especially in areas they are not very familiar with. Also, ISPs have already large customer base. So in fact, for a customer, it would mean only adding some extra items to the agreement.
- Strong partnering experience
  - This will help in negotiations and in keeping good relationship with wireless networks service providers.

Various roles in the business model

Mobile operators

- A packet service offer
  - A mobile operator is able to offer customers a packet of mobile phone services and wireless Internet connection. ”Use WLAN where available and GSM data/ UMTS elsewhere!” Such solution is especially convenient and appealing to business users who need reliability.
- Large customer base and large experience in customer relationship
  - For home operators, it is crucial to focus on the customer relationships. Experience in this area has a great importance.
- Experience in billing
  - Mobile operators have already built up billing systems and working billing relationships with their customers.
- Existing networks infrastructure
  - Networks can be used somehow for wireless Internet connections. They also have experience in building up networks.

Various roles in the business model

Telecoms

- Big size
  - Telecoms are usually very big companies. This can provide more stability and make it easier to collect the agreements with wireless service providers.
- Experience with advertising, networks etc.
- Large customer base and experience in customer relationships
  - Nowadays, ISPs, telecoms and mobile operators could be the same companies but as it doesn't have to be so (and it is not, in many cases), we handle them as separate companies.

Various roles in the business model

Wireless network service providers

Wireless network service providers are companies who have brought WLAN capacity and offer a service of wireless Internet connection. In some cases, a network owner can act on the same time as a network service provider.

In the case of wireless LANs, the service provider firm's size does not matter because even an operator with only one base station could be the only one providing connectivity in this area.

Various roles in the business model

Brokers

Broker is a possible connecting link between the home operator and the wireless network service providers. It simplifies the connections between the parts of the network business model. Broker can also mediate trust.

Various roles in the business model

Foreign network

Foreign networks are built by network owners, who then sell out their capacity. Probably the whole capacity is sold to one service provider, but there could be more, if the capacity is divided.

Wireless networks could be built for various purposes:

1. Networks could be built especially for public access. There could be two types of network builders in this case. Some firms will specialize on building the networks and selling the capacity to operators without keeping any decision rights, only the ownership of the equipment. Some network owners could act at the same time as wireless network service providers.
2. Networks could be also built in order to attract customers to the main business. For example, wireless Internet access could draw more customers to a café or airport lounge.
3. Networks could be built primarily for internal use, but some of the excess capacity is sold for public users.

Various roles in the business model

Payment methods

1 Prepayment

No credit is provided. The user has to pay before access is allowed.

One scheme of using prepayment method could be as follows. The user has deposited some amount of money to his home operator. When the mobile node connects a foreign network, he either shows a certificate that he has the deposit or foreign agent connects the home operator in order to get information about user funds. The user then reserves some bandwidth for a fixed time, during which he thinks to going to use the service. The foreign agent sends a message to the home operator to freeze the amount that equals the cost of using the reserved service. After the user has finished using the service, the money is charged from home organization and remaining funds (if any) are released.

2 Continuous paying

2.1 Micropayment

The main idea of the micropayment method is to pay in such a small increments that the user can afford to lose one single payment and the network is not interested in cheating in order to get one payment amount. Micropayments have a number of advantages over other payment methods. First, in most cases, it is efficient. Second, the user can control how much he is really spending, so there will be no “unpleasant” surprises at the end of the month. Third, the user doesn’t have to trust the foreign network. As the single payments are so small, user can always pay first one coin and then stop further paying if he feels that he did not get the service quality that was promised to him, or that he did not get service at all. The micropayment techniques make sure that if the service breaks down for some reason, the payment flow stops automatically.

2.2 (Possibly anonymous) electronic cash

Electronic cash is less efficient than micropayments. However, it also requires less trust to the service provider. Most importantly, electronic cash can provide strongly anonymous payments. While one could argue that anonymity does not fit well together with the structure of Mobile IP, where behavioral patterns of users are easy to trace, we could still imagine that in some specific places anonymity could be useful and achievable. One possibility for this would be the usage of “Mobile IP anonymizers” that hide at least a part of the traffic.

2.3 Monthly billing

Data is collected and the payment takes place afterwards (usually at the end of the month). In the early days of wireless Internet access, payment for the services is probably going to be based on a flat monthly rate. Customers are used to paying so. As the system develops further, price differentiation will appear in the scene. For poorer or yet mistrusted customers, prepayment is a suitable solution.

Various roles in the business model

Pricing

Advertising and pricing

To attract more customers, the foreign network advertises its services over air. In order to compete with other networks situating near the mobile node (potential customer), foreign networks should include at least some information about its prices in the advertisement message.

In the future the competition could get so tight that price level of different operations would be similar enough for the mobile node not to care to which network it is connecting. There would be still some networks that would grant free access to specific customers. So, in any case, there would be a competition between networks to attract customers. As one should not produce much overhead in first signals sent to potential customers, the best idea would be to attach 2, 3 general prices to the broadcast advertisement message and to allow mobile nodes free access to a web-page for further information.

There are always some customers to which foreign network wants to give free access or at least reduced prices. In this case, the mobile node could answer to first network advertisement message with a certificate that proves it is the person to whom the privileges belong. The mobile node attaches a little message to the certificate that shows if he would like to get price information in next message or not. If you are used to visiting one café every week, you probably know their price list and would like to get the price information only in case of changes or special offers.

Various roles in the business model

Pricing

Pricing differentiation

Wireless network access could be used for various activities. One could want to check out if there are some new e-mails, or one could listen to mp3s while shopping in grocery hall. As those services need different bandwidths, so it will be neither reasonable nor fair to

grant the price by used minutes or by transferred bytes only. The solution is to work out pricing packets from which the customer will choose the suitable one.

1. **Price per time unit.**

For example, 1 Euro per 1 hour for staying registered in the foreign network. This allows using instant messaging, waiting emails, etc. It depends on the network if the customer could use the capacity left from other users or he'll be given a minimum capacity for staying in network. In this case, if the customer receives or sends an email, he has to pay more for the kilobytes transferred.

2. **Price per kilobytes transferred.**

For example, 1 cent per 1 kilobyte. This price packet is suitable for web browsing, files transfer, reading email etc. Packets (1) and (2) together offer the possibility to pay a little for staying in the foreign network and then pay more for every action you are doing. So this would probably be the most common method of payment in the future.

3. **Price per bandwidth reserved.**

For example, 50 cents per minute. Reservation is needed for audio and video streaming, IP telephony, etc. Reserved bandwidth is technically quite difficult to implement and can be provided only to a few users at a time.

Payment methods

1 Prepayment

No credit is provided. The user has to pay before access is allowed.

One scheme of using prepayment method could be as follows. The user has deposited some amount of money to his home operator. When the mobile node connects a foreign network, he either shows a certificate that he has the deposit or foreign agent connects the home operator in order to get information about user funds. The user then reserves some bandwidth for a fixed time, during which he thinks to going to use the service. The foreign agent sends a message to the home operator to freeze the amount that equals the cost of using the reserved service. After the user has finished using the service, the money is charged from home organization and remaining funds (if any) are released.

2 Continuous paying

2.1 Micropayment

The main idea of the micropayment method is to pay in such a small increments that the user can afford to lose one single payment and the network is not interested in cheating in order to get one payment amount. Micropayments have a number of advantages over other payment methods. First, in most cases, it is efficient. Second, the user can control how much he is really spending, so there will be no “unpleasant” surprises at the end of the month. Third, the user doesn’t have to trust the foreign network. As the single payments are so small, user can always pay first one coin and then stop further paying if he feels that he did not get the service quality that was promised to him, or that he did not get service at all. The micropayment techniques make sure that if the service breaks down for some reason, the payment flow stops automatically.

2.2 (Possibly anonymous) electronic cash

Electronic cash is less efficient than micropayments. However, it also requires less trust to the service provider. Most importantly, electronic cash can provide strongly anonymous payments. While one could argue that anonymity does not fit well together with the structure of Mobile IP, where behavioral patterns of users are easy to trace, we could still imagine that in some specific places anonymity could be useful and achievable. One possibility for this would be the usage of “Mobile IP anonymizers” that hide at least a part of the traffic.

2.3 Monthly billing

Data is collected and the payment takes place afterwards (usually at the end of the month). In the early days of wireless Internet access, payment for the services is probably going to be based on a flat monthly rate. Customers are used to paying so. As the system develops further, price differentiation will appear in the scene. For poorer or yet mistrusted customers, prepayment is a suitable solution.

Generic Charging Models for Mobile and Internet usage

Metered charging
Usage based pricing
Fixed Price
Paris- Metro
Packet charging
Edge pricing

Other Models

- Smart Markets
- Expected capacity
- Fair pricing
- Quota based charging
- Fair Allocation

Fixed Priced & Metered Connection

£10 == One Months Connection
plus call charges @ 10p/Minute

£10 == One Months Connection
all call charges inclusive

- Simplest charging & billing scenario
- Often called 'Subscription' billing
- Widely used for Internet and telephony services

Packet charging and Edge charging

£10 == One Months Connection

plus packet charges @ 0.001p/packet Rx/Tx

£10 == One Months Connection

plus edge packet charges @ 0.1p/packet Rx/Tx

- More complex charging & billing scenarios
- Additional cost associated with 'packet counting'
- Highly variable charges for the user

Paris-Metro

Travel Class associated with network traffic

1st, 2nd & 3rd Class

Congestion control by 'natural selection'

"If 1st class is full then use the 2nd class"

- Complex charging & billing scenario
- Difficult to implement and police
- Unfair benefit to various users

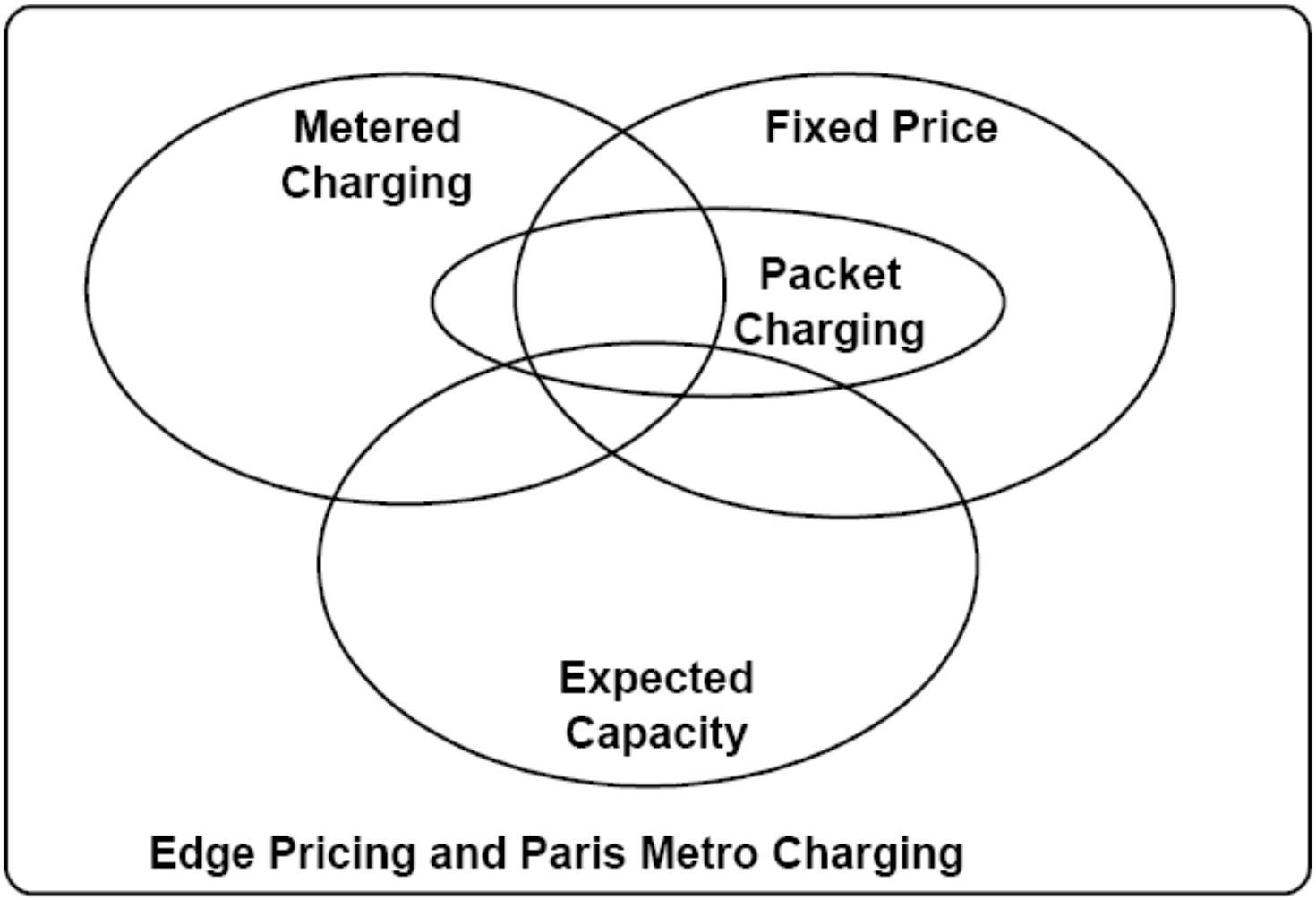
Expected Capacity charging

Subscribers pay for their expected capacity requirements.

If more capacity is used then additional penalty charges apply

- Complicated charging & billing scenario
- Simplifies network provisioning for network providers
- Not simplistic to implement and police

Current trend



Edge Pricing and Paris Metro Charging

Separation of charges

Transport plane

Service plane

Content plane

Security requirements

VASP :

- Restricted access
- Client authentication

User :

- Protection of mobile terminal resources
- Protection of his/her private life e.g. “Anonymity” when accessing VAS

VAS (mobile code) :

- Intellectual property rights protection
- Conditions of use
- Run-time tuning and control