

Sistem Terdistribusi

Multimedia & Mobile Computing

Multimedia

- Multimedia become **common** things in everyday life
- Hardware/software getting **cheaper**
- Technology advances so **fast**
- We want more: **Text, Image, Audio, Video**
- Many of today's computer systems provide some capacity to handle multimedia data, but the necessary resources are very **limited**.
- Especially, when dealing with **large** audio and video streams many systems are constrained in the **quantity** and **quality** of streams they can support

Definisi Multimedia

Beberapa definisi menurut beberapa ahli:

1. Kombinasi dari komputer dan video (*Rosch, 1996*)
2. Kombinasi dari tiga elemen: suara, gambar, dan teks (*McComick, 1996*)
3. Kombinasi dari paling sedikit dua media input atau output. Media ini dapat berupa audio (suara, musik), animasi, video, teks, grafik dan gambar (*Turban dan kawan-kawan, 2002*)
4. Alat yang dapat menciptakan presentasi yang dinamis dan interaktif yang mengkombinasikan teks, grafik, animasi, audio dan video (*Robin dan Linda, 2001*)
5. Multimedia dalam konteks komputer menurut Hofstetter 2001 adalah: pemanfaatan komputer untuk membuat dan menggabungkan teks, grafik, audio, video, dengan menggunakan tool yang memungkinkan pemakai berinteraksi, berkreasi, dan berkomunikasi.

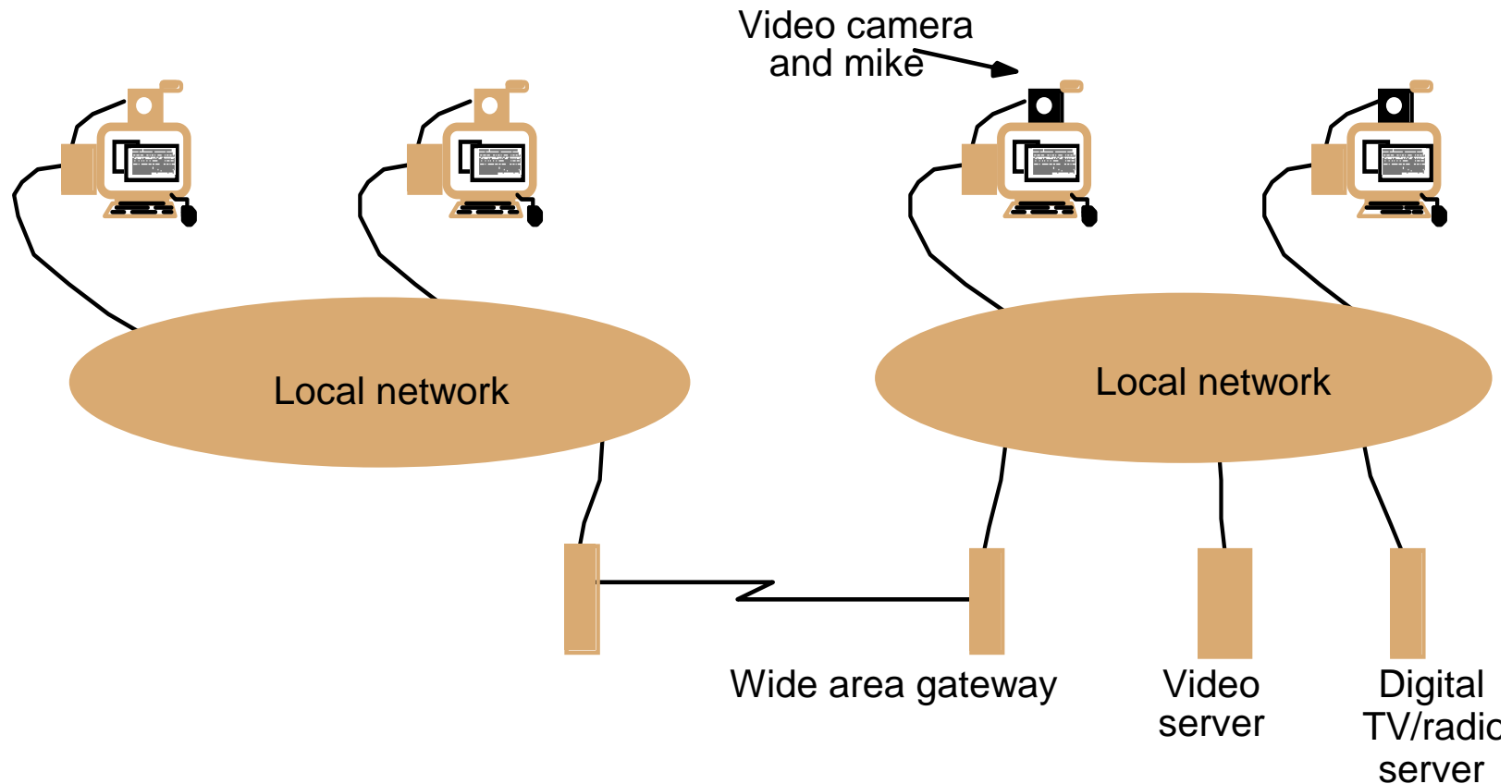
Karakteristik Data Multimedia

- Multimedia data (video and audio) is **continuous** and **time-based**.
 - Continuous: is represented as **sequence** of **discrete** values that replace each other over **time**.
 - Non continuous: text, image
- Memiliki karakteristik:
 - **Voluminous**
 - Membutuhkan data rate tinggi dan berukuran besar
 - **Real-time and Interactive**
 - Membutuhkan delay yang kecil
 - Membutuhkan sinkronisasi dan interaktif

Data Rate Multimedia

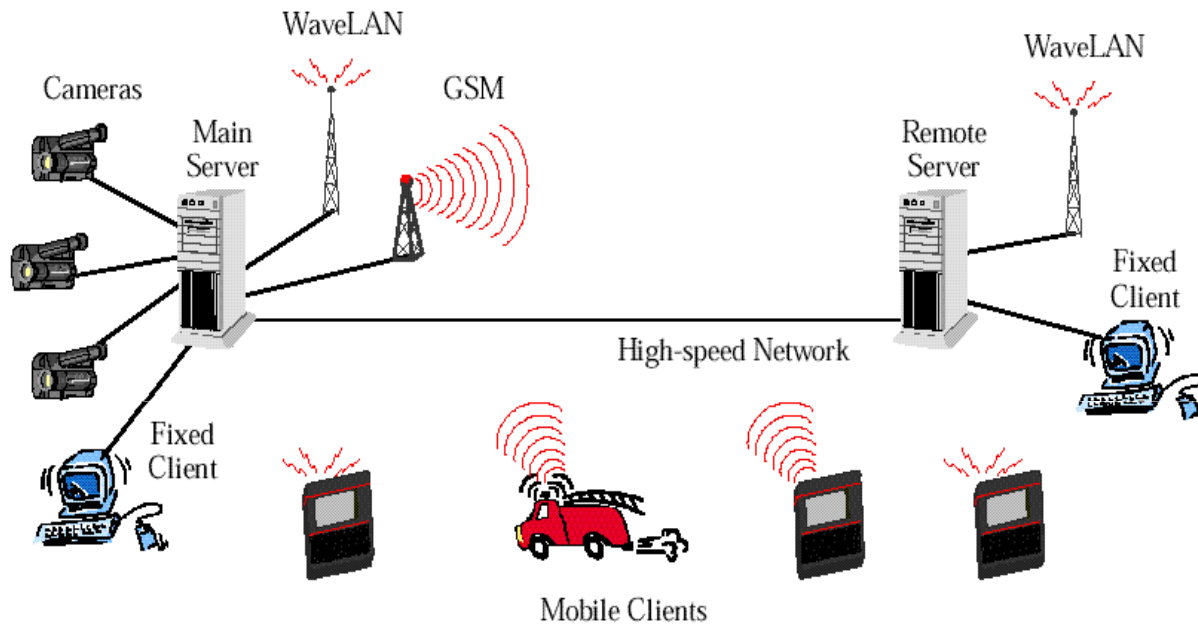
	<i>Data rate (approximate)</i>	<i>Sample or frame size frequency</i>	
Telephone speech	64 kbps	8 bits	8000/sec
CD-quality sound	1.4 Mbps	16 bits	44,000/sec
Standard TV video (uncompressed)	120 Mbps	up to 640 x 480 pixels x16 bits	24/sec
Standard TV video (MPEG-1 compressed)	1.5 Mbps	variable	24/sec
HDTV video (uncompressed)	1000–3000 Mbps	up to 1920 x 1080 pixels x24 bits	24–60/sec
HDTV video (MPEG-2 compressed)	10–30 Mbps	variable	24–60/sec

Distributed Multimedia



- capable of supporting a variety of applications :
 - **non-interactive**: net radio and TV, video-on-demand, e-learning, web based ...
 - **interactive**: voice & video conference, interactive TV, tele-medicine, multi-user games, live music, ...

Multimedia in a mobile environment



- capable of supporting a variety of applications :
 - emergency response systems, mobile commerce, phone service, entertainment, games, ...

Characteristics of multimedia applications

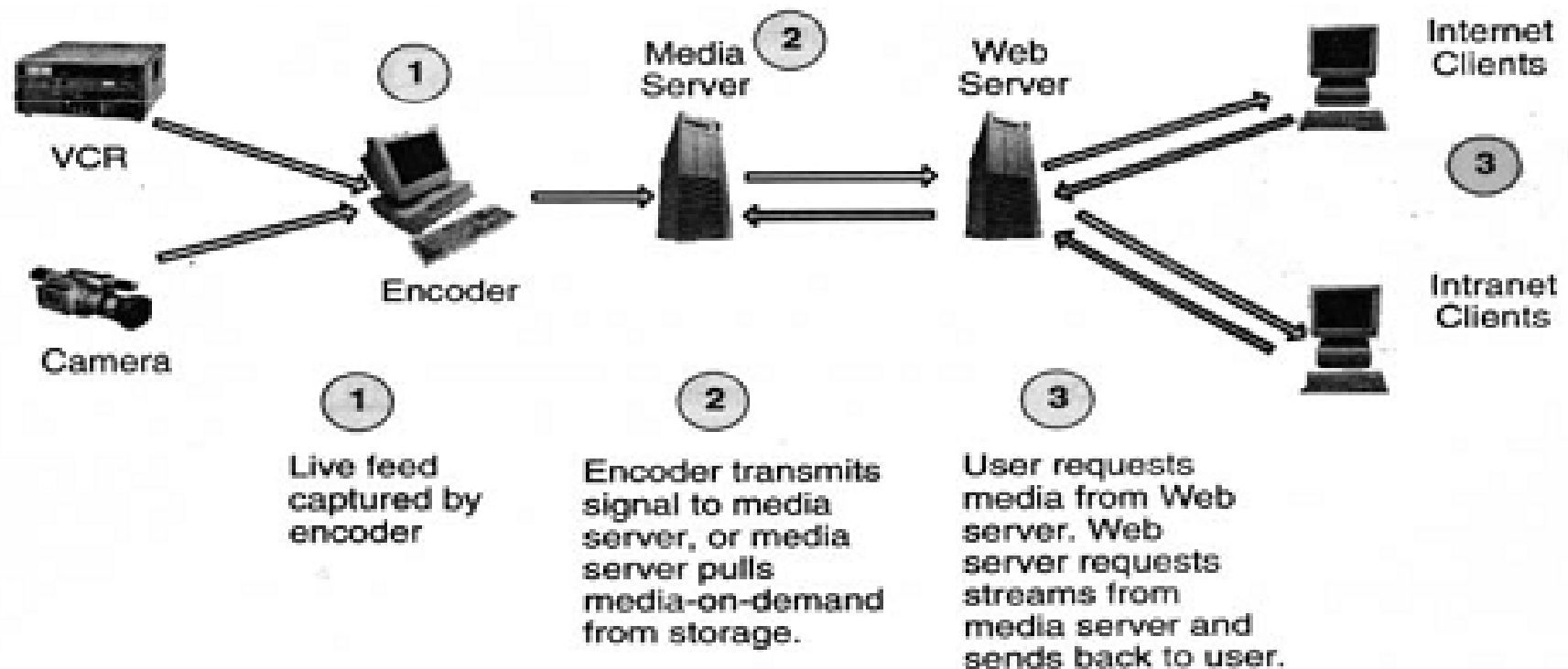
- **Large** quantities of continuous data
- Timely and smooth delivery is **critical**
 - deadlines
 - throughput and response time guarantees
- Interactive MM applications require **low** round-trip **delays**
- Need to **co-exist** with other applications
- Reconfiguration is a **common** occurrence
 - varying resource requirements
- Resources required:
 - Processor cycles in workstations and servers
 - Network bandwidth (+ latency)
 - Dedicated memory
 - Disk bandwidth (for stored media)

Multimedia & Internet

- **MIME** (Multipurpose Internet Mail Extension) digunakan untuk mendeteksi file multimedia di Internet
 - Text (text/plain, text/html)
 - Image (image/gif, image/jpeg, image/png)
 - Video (video/mpeg, video/quicktime)
 - Audio (audio/basic, audio/wav)
 - Application (application/msword, application/octet-stream)
- Saat browser menjumpai MIME type, browser melakukan salah satu dari hal-hal berikut:
 - mulai mengirimkan file dan membukanya menggunakan program aplikasi yang telah asosiasikan sebelumnya. (=> helper)
 - mengizinkan user menyimpan file ke dalam disk/harddisk (=> download)
 - menanyakan pada user aplikasi apa yang akan digunakan untuk membuka file atau langsung dijalankan menggunakan plugin (=> plugin)
 - mengizinkan user membatalkan transfer file (=> cancel)

Streaming multimedia

- **Streaming media** adalah suatu teknologi yang mampu mengirimkan file audio dan video digital secara **real time (delay sangat kecil)** pada jaringan komputer



Streaming vs Download

- **Download**

- (+) download dan simpan file dalam HD sehingga dapat dinikmati pada saat offline.
- (+) dapat dilihat berkali-kali.
- (+) standard file (bisa dibaca oleh semua jenis mesin).
- (+) kualitas bagus
- (-) waktu download lama karena ukuran besar

- **Streaming**

- (+) dapat dilakukan pada bandwidth dengan kecepatan rendah
- (+) Server tidak perlu risau dengan bandwidth
- (+) Server tidak dibatasi oleh besar file
- (-) Hanya dapat dilihat pada saat online
- (-) Kualitas gambar jelek

Protokol Streaming

- **RSVP** – Resource Reservation Protocol
 - digunakan untuk mereserve bandwidth sehingga data dapat tiba ditujuan dengan cepat dan tepat.
- **SMRP** – Simple Multicast Routing Protocol
 - Protocol yang mendukung ‘conferencing’ dengan menggandakan (multiplying) data pada sekelompok user penerima
- **RTSP** – Real-Time Streaming Protocol (RFC 2326)
 - digunakan oleh program streaming multimedia untuk mengatur pengiriman data secara real-time, tidak bergantung pada protokol Transport.
 - Metode yang ada: PLAY, SETUP, RECORD, PAUSE dan TEARDOWN
 - Digunakan pada Video on Demand

Protokol Streaming Multimedia

- **RTP** – Real Time Transport Protocol (RFC 1889)
 - suatu standard untuk mengirimkan data multimedia secara real-time, bergantung pada protokol Transport
 - Berjalan diatas UDP tapi bisa juga diatas protokol lain
- **RTCP** – Real-Time Control Protocol
 - Protocol QoS (Quality of Service) untuk menjamin kualitas streaming.
 - Merupakan bagian pengontrolan paket data pada RTP

Application requirements example

- Network phone and audio conferencing
 - relatively low bandwidth (~ 64 Kbits/sec), but delay times must be short (< 250 ms round-trip)
- Video on demand services
 - High bandwidth (~ 10 Mbits/s), critical deadlines, latency not critical
- Simple video conference
 - Many high-bandwidth streams to each node (~1.5 Mbits/s each), high bandwidth, low latency (< 100 ms round-trip), synchronised states.
- Music rehearsal and performance facility
 - high bandwidth (~1.4 Mbits/s), very low latency (< 100 ms round trip), highly synchronised media (sound and video < 50 ms).

QoS

- **QoS**: the management and allocation of resources to provide **guarantee** of service
- **Allocate** resource to provide **better** service of quality
 - according to their needs in order to achieve the desired quality of multimedia delivery
- Best-efforts manner, but **collision** can't be avoided
- Element QoS:
 - **Admission control**: controls demand
 - **QoS negotiation**: enables applications to negotiate admission and reconfigurations
 - **Resource management**: guarantees availability of resources for admitted applications
 - **real-time** processor and other resource scheduling

QoS Parameters

The RFC 1363 Flow Spec

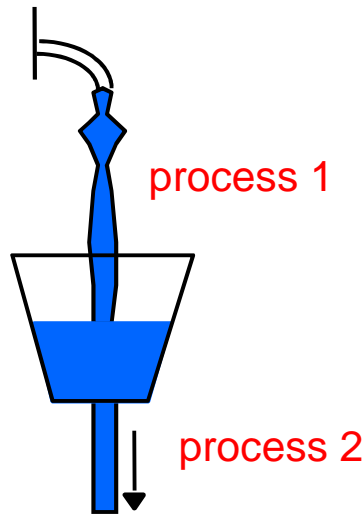
	Protocol version	
Bandwidth:	Maximum transmission unit	} burstiness
	Token bucket rate	
	Token bucket size	
	Maximum transmission rate	
Delay:	Minimum delay noticed	maximum rate
	Maximum delay variation	acceptable latency acceptable jitter
Loss:	Loss sensitivity	percentage per T
	Burst loss sensitivity	maximum consec- utive loss
	Loss interval	T
	Quality of guarantee	value

Parameter QoS (lengkap)

- **Data Rate**: ukuran kecepatan transmisi data, satuannya kbps or Mbps
- **Bandwidth** : banyaknya aliran data multimedia
- **Latency** (maximum packet delay) : waktu maksimum yang dibutuhkan oleh individual data element untuk berpindah dari sumber ke penerimaan yang diukur dengan satuan milidetik
 - Dalam voice communication: ≤ 50 ms
- **Packet Loss / Error** : ukuran error rate dari transmisi packet data yang drop (diukur dalam persen)
 - Packet hilang (bit loss) yang biasanya dikarenakan buffer yang terbatas, urutan packet yang salah termasuk dalam error rate ini.
- **Jitter** : ukuran delay penerimaan paket yang melambangkan smoothness dari audio/video playback.

Buffering: leaky bucket algorithm

(a) Leaky bucket



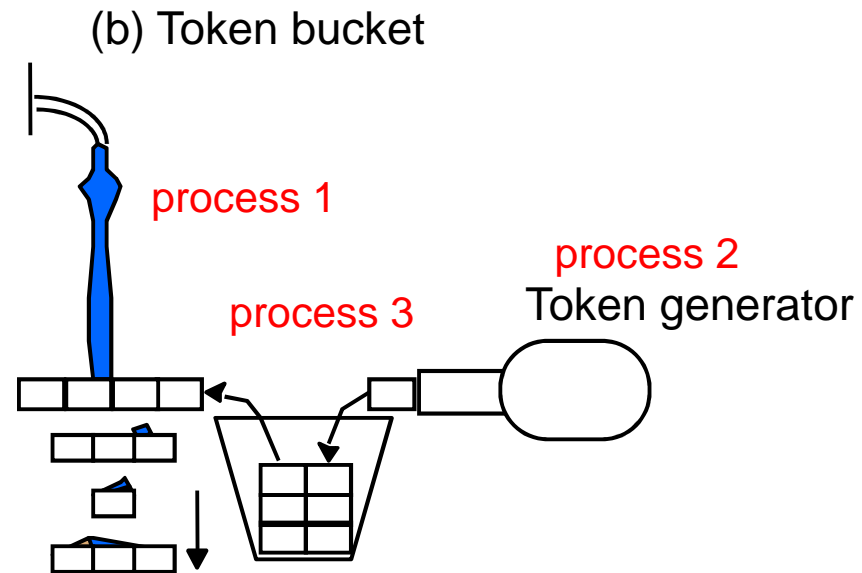
The bucket can be filled arbitrarily with water until it is full. Through a leak at the bottom of the bucket water will flow out.

analogue of leaky bucket:

- process 1 places **data** into a buffer in bursts
- process 2 is scheduled to **remove** data regularly in smaller amounts
- size of buffer B , determines:
 - maximum permissible burst without loss
 - maximum delay

Buffering: token bucket algorithm

tokens: permits to place x bytes into output buffer



Implementation process

- process 1 delivers data in bursts
- process 2 generates tokens at a fixed rate
- process 3 receives tokens and exploits them to deliver output as quickly as it gets data from process 1

Mobile Computing

- **Mobile Computing** : A technology that allows transmission of data, via a computer, without having to be connected to a fixed physical link.
- Karakteristik: mobility (**anywhere**) dan broad reach (**anytime**)
- Yang termasuk teknologi mobile computing:
 - laptop dengan wireless LAN
 - mobile phone
 - wearable computer
 - Personal Digital Assistant (PDA) dengan Bluetooth atau IRDA

Problem with mobile

- **No direct** connectivity between two devices
- **Continuous** connectivity for mobile devices outside base stations range
- Devices must be able to communicate with others even if there's **no infrastructure**
- Bandwidth is **limited**

Terms

- Ubiquitous computing: (Mark Weiser 1988)
 - To be found everywhere
- Wearable computing:
 - Devices attached to clothes, worn like watches, jewellery, ...
- Context-aware computing:
 - Teknologi yang “mengerti” kita
 - E.g: device will automatically switch itself to “vibrate” instead of “ring” when it is in the cinema

Wearable Computer

- Suatu computer yang “ditanamkan / embedded” di dalam sebuah peralatan yang dapat digunakan oleh manusia





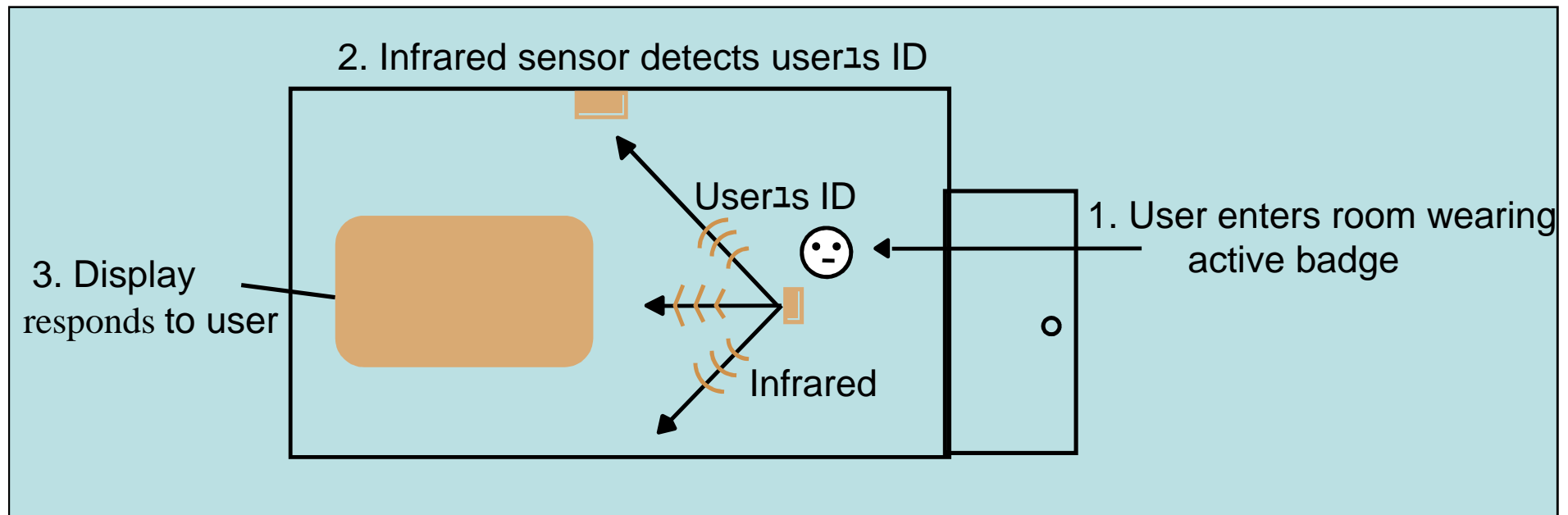
LCD Jacket





Wearable Computer

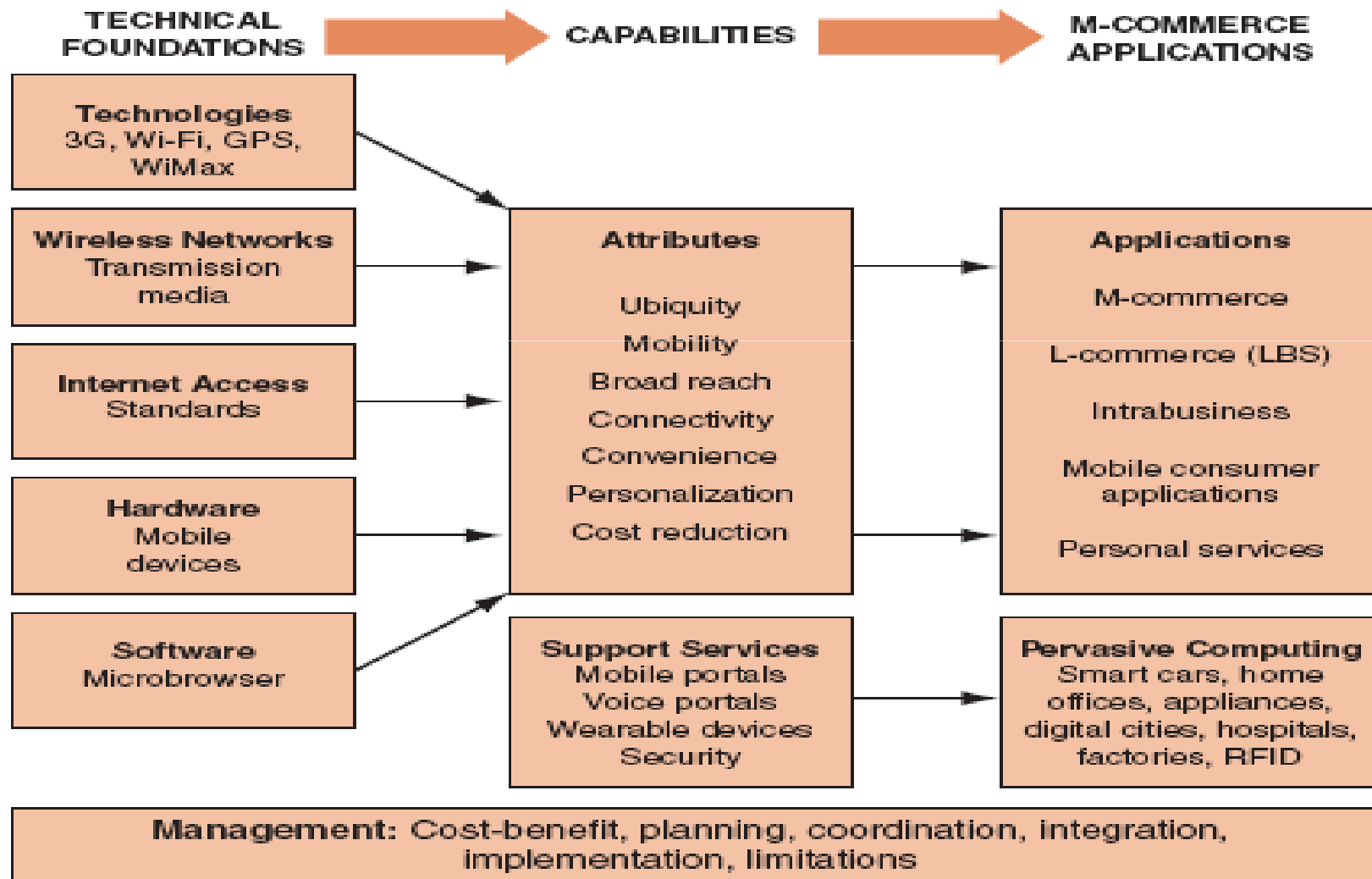
- Active badge was **one of the first applications**
 - Badge regularly broadcasts it's identity
 - Infrared sensor detects the users identity



Ubiquitous computing



Landscape of Mobile Computing



Pervasive Computing

- **Technology View**

- Computers everywhere – embedded into washing machines, door locks, cars, furniture, people
 - intelligent environment
- Mobile portable computing devices
- Wireless communication – seamless mobile/fixed

- **User View**

- Invisible – implicit interaction with your environment
- Augmenting human abilities in context of tasks
- Ubiquitous = mobile computing + intelligent

Context-aware computing

- System becomes more intelligent
 - Mobile phone vibrate instead of ringing on church
 - MP3 player plays love song when a couple dates
 - Braking system auto adjustment for road condition
- Sensors play major role
 - Location sensing
 - Tracking

Aplikasi Pervasive Computing

- Smart home / School
 - Lighting system
 - Energy management
 - Water control
 - Home security
 - Home theater
- Smart cars
- Intelligence Elder care
- Digital cities

Location-sensing

- **Location sensing** has received most attention of **ubiquitous computing**
- For location sensing you can get data of **living** and **non living** objects
- A big issue of location sensing is **privacy**
- If something else determines your location you could be **tracked**

Some location-sensing technologies

<i>Type</i>	<i>Mechanism</i>	<i>Limitations</i>	<i>Accuracy</i>	<i>Type of location data</i>	<i>Privacy</i>
GPS	Multilateration from satellite radio sources	Outdoors only (satellite visibility)	1–10m	Absolute geographic coordinates (latitude, longitude, altitude)	Yes
Radio beaconing	Broadcasts from wireless base stations (GSM, 802.11, Bluetooth)	Areas with wireless coverage	10m–1km	Proximity to known entity (usually semantic)	Yes
Active Bat	Multilateration from radio and ultrasound	Ceiling mounted sensors	10cm	Relative (room) coordinates.	Bat identity disclosed
Ultra Wide Band	Multilateration from reception of radio pulses	Receiver in stallations	15cm	Relative (room) coordinates	Tag identity disclosed
Active badge	Infrared sensing	Sunlight or fluorescent light	Room size	Proximity to known entity (usually semantic)	Badge identity disclosed
Automatic identification tag	RFID, Near Field Communication, visual tag (e.g. barcode)	Reader installations	1cm–10m	Proximity to known entity (usually semantic)	Tag identity disclosed
Easy Living	Vision, triangulation	Camera installations	Variable	Relative (room) coordinates	No

Security and privacy

- Portable devices are easier **stolen** and tampered with than PC's
- Due to **limitations** mobile devices sometimes don't have enough resources for **cryptography** (energy or computing resources)
- Since mobile devices are **disconnected** often you **shouldn't depend** on a server for security

End

- The End
 - TAS: open slide, dari tengah