

Lecture 2

Middleware in action

A. Content download on a mobile

- Interacting devices: mobile device, access point(s), routers, communication infrastructure, web server.
- Application: the client browser contacts the web server and issues a download request for a page.
- Supporting services: DHCP, DNS, *content adaptation*, caching, mobility management.
- Why are these considered to be middleware services?
- Answer:
 - Support many applications/clients/devices;
 - Hide heterogeneity;
 - The user is unaware of their execution.

Content adaptation

- Content adaptation is determined by the application requirements and may take into account the quality of the wireless link, mobile device's resources, user preferences and supported protocols.
- There are several techniques for data adaptation:
 - Distillation and refinement
 - Summarization
 - Filtering
 - Trans-coding

Distillation and refinement

- Distillation is a compression technique that tries to eliminate redundant/unnecessary data while preserving most of the semantic content of the data.

Examples: images scaled down on each dimension, or reduction of the colour depth.

- Refinement is the process of selecting certain parts of the document in its original quality.
- The two methods are generally used together.

Summarization and filtering

- Selected parts of the original data are selected for presentation, aiming at the least possible loss of information.

Example: a video summary is a sequence of still or moving pictures, with or without audio, that preserves the original message.

- Intelligent filtering: transform, drop or delay data delivery by applying filters on the data path, according to the network or device requirements.

Example: active filters – QoS - aware services for mobile multimedia applications.

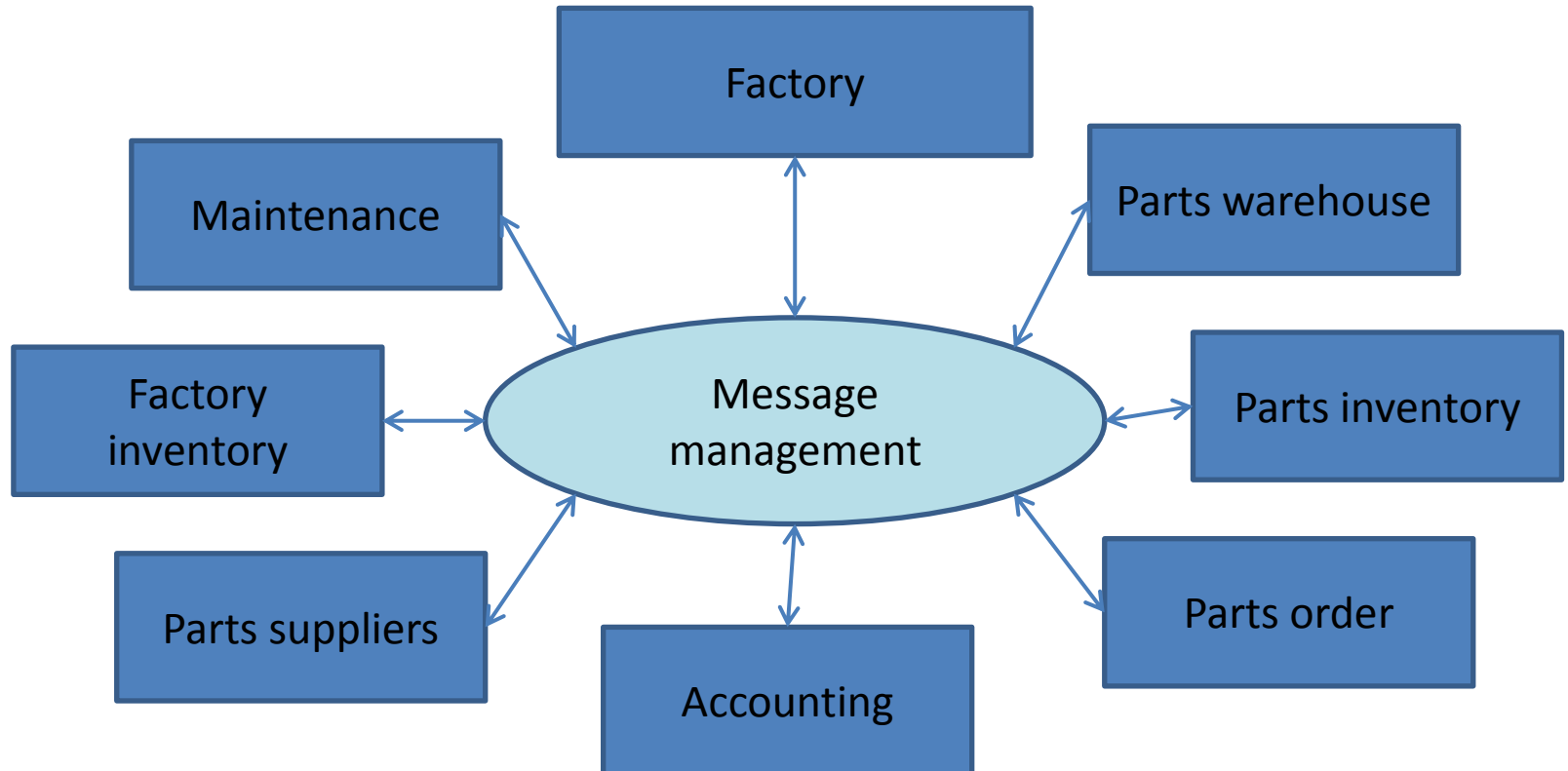
Trans-coding

- It is a technique of transforming the format and representation of content – it is commonly used for the conversion of the video formats (e.g., QuickTime to MPEG), or the adjustment of HTML and graphics files to mobile devices.
- Unlike image data where trans-coding steps are obvious, video data represents a great challenge.
 - The structure of video is a hierarchy of the movie. This hierarchy is composed of segments, scenes, and shots. Each segment consists of sequence of scenes, each scene consists of several shots, and each shot is composed of several frames which have similar visual properties. Thus one of these frames can be selected as a Representative frame for the shot.
 - The video is presented to the user by the *representative frames* which are picked from each shot.

B. Enterprise IT system

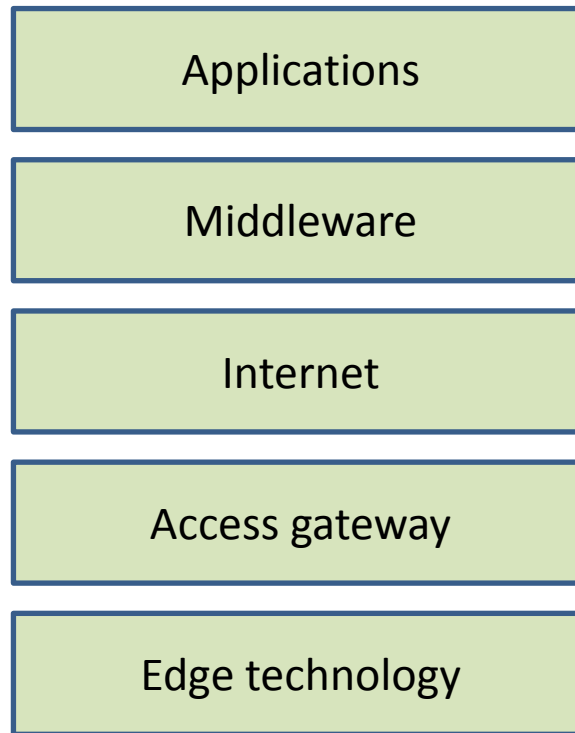
- Interacting devices: computers of different forms and functionality, sensors, networked production equipment.
- Applications: production management, HR, accounting, etc
- Supporting services: messaging, caching, protocol trans-coding on top of networking.
- Messages are exchanged between any two departments. Messages are stored, processed (e.g., filtered), delivered to destination.

Message-oriented middleware application: production management



C. Internet of Things

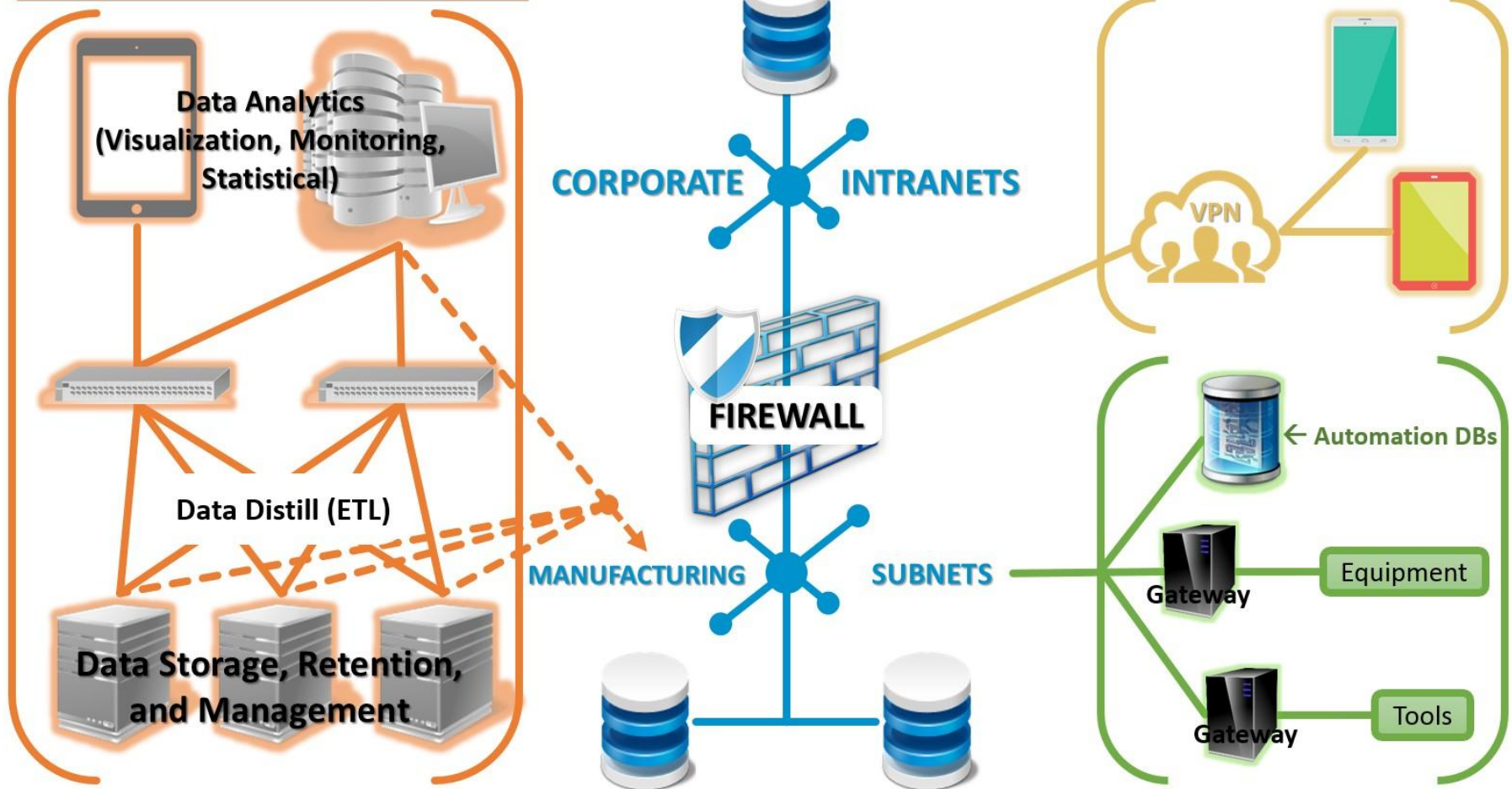
- IoT is the large Internet that connects all communicating devices that interact with our environment.
- IoT layers are:



IoT middleware

- The functional components of the IoT middleware are:
 - Interface protocols
 - Device abstraction
 - Central control, context detection & management
 - Application abstraction

Private Cloud Infrastructure



Conclusions

- The vast majority of distributed applications is using middleware services.
- Different applications/devices can use different middleware services.
- Answer the following questions:
 - What is the purpose of a middleware service?
 - Where are located middleware services?
 - How can a middleware service be effective?
 - How can middleware services cooperate among themselves?