System architecture I

18th Jan 2018

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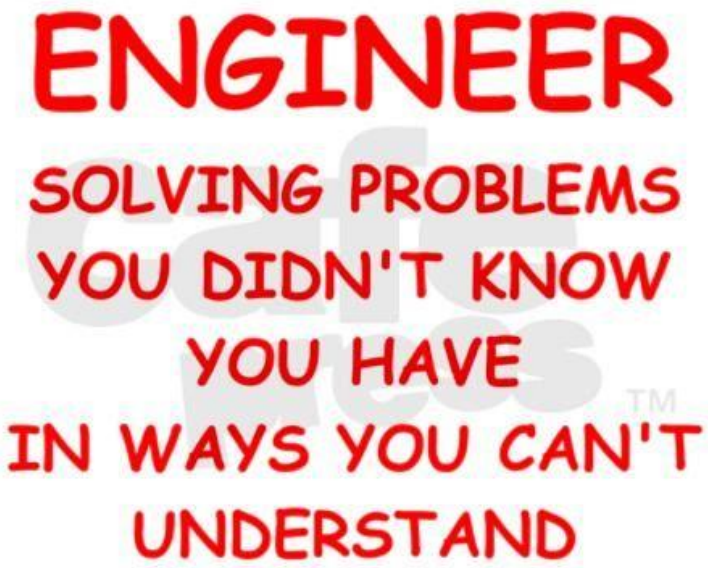
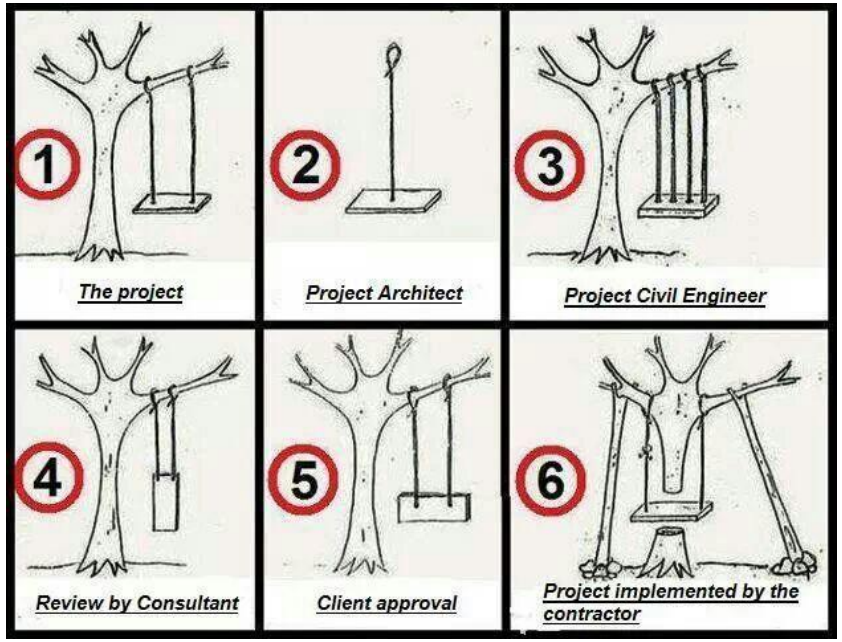
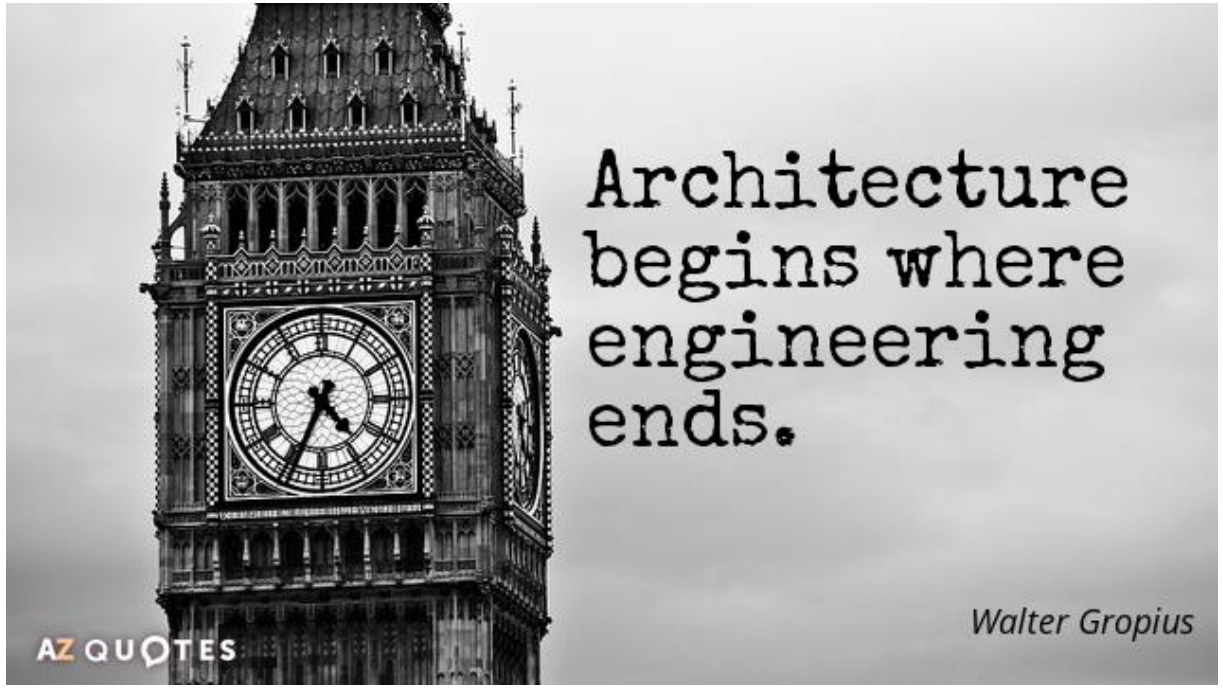
ENGINEERING FACT

You know you're in engineering when you leave a class feeling dumber than when you went in.




1
The project
2
Project Architect
3
Project Civil Engineer
4
Review by Consultant
5
Client approval
6
Project implemented by the contractor


Architecture begins where engineering ends.
Walter Gropius
AZ QUOTES

System Interfaces

- Objective 1:

Physically link or bind two or more system elements or entities.

- Objective 2:

Adapt one or more incompatible system elements or entities.

- Objective 3:

Buffer the effects of incompatible system elements.

- Objective 4:

Leverage human capabilities.

- Objective 5:

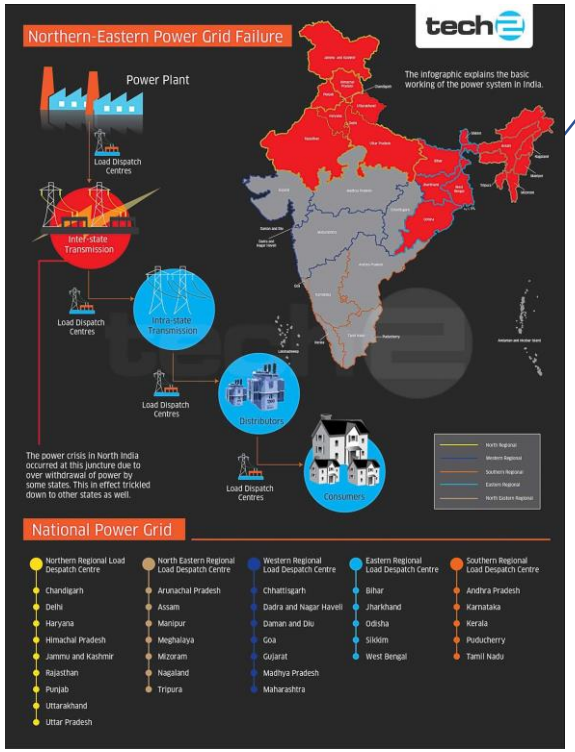
Restrain system element or its usage. Interoperability—The Ultimate Interface Challenge

Understanding Interfaces

- What Constitutes an Interface Failure?
- Consequences of an Interface Failure
- Interface Failures
- 1) disruption; 2) intrusion 3) stress loading, and 4) physical destruction
- Interface Vulnerabilities
- Interface Latency
- Interface Failure Mitigation and Prevention

We have to change the **system**

For driverless cars to ply on Indian roads, the **system** has to change



Northern Grid power failure, July 30 2012

Certain states in the northern region overdrew power

- possible reasons for overdrawing power is the deficient rainfall, which meant increased use of electric pumps to withdraw water for farming in these agricultural states

- The generation plants, the power grids and the sub-stations have to work in tandem.

An overload results in system failure

Why the railways suffer on an average 100 accidents a year

Over 700,000 people work on safety-related operations at the country's largest employer, according to Indian Railways' response to a Parliament question. A small slip by one of them, or a single flaw in the 66,030km track criss-crossing the country can affect one or more of 10,773 locomotives, 63,046 coaches and 245,000 wagons , jeopardizing the 23 million passengers and three million tonnes of freight that the network carries everyday.

Indian Railways has divided its 66,030km of track into 1,219 sections and out of these 492 are running at 100% capacity, in some cases more. Most accidents occur on these over-capacity routes

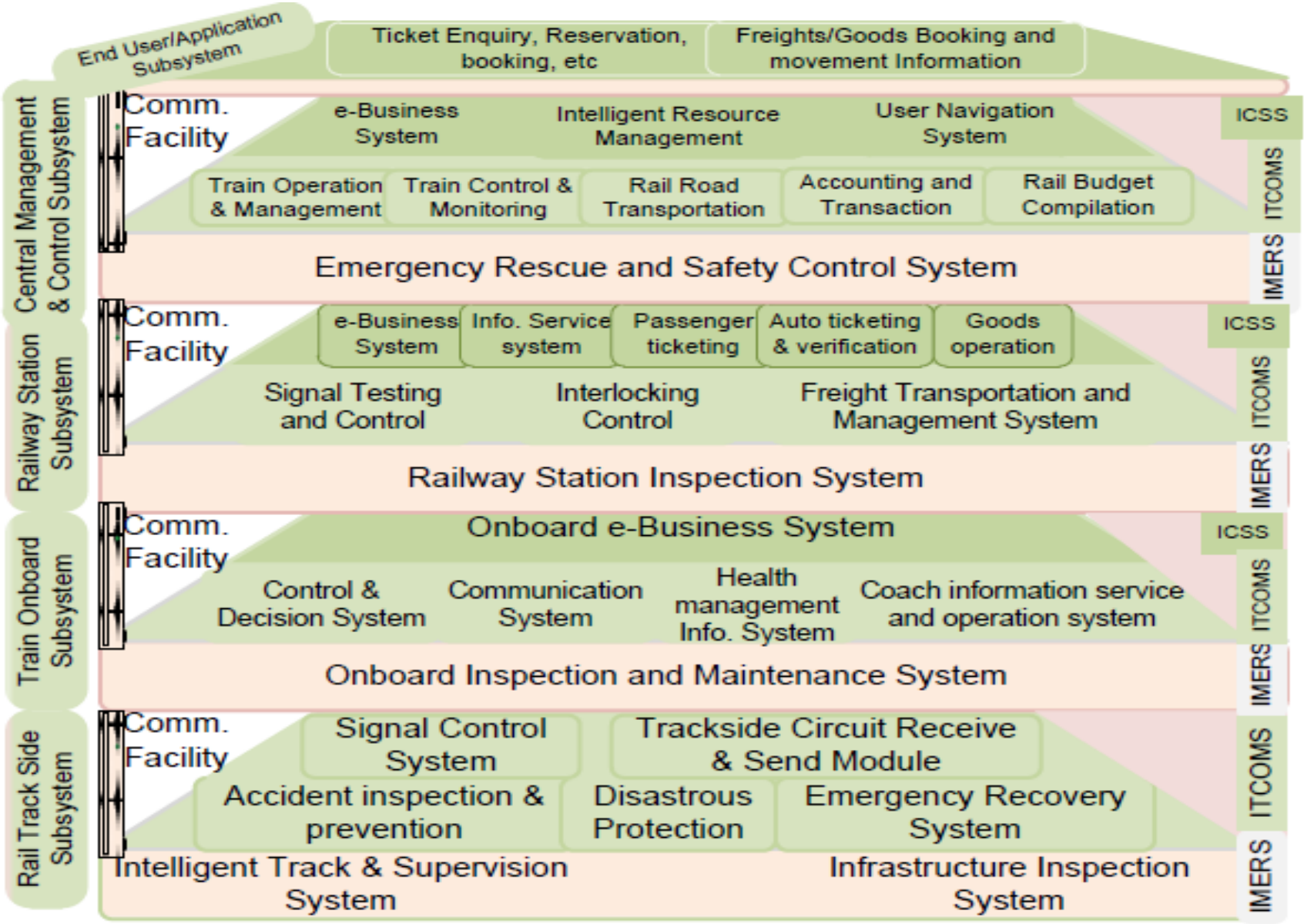


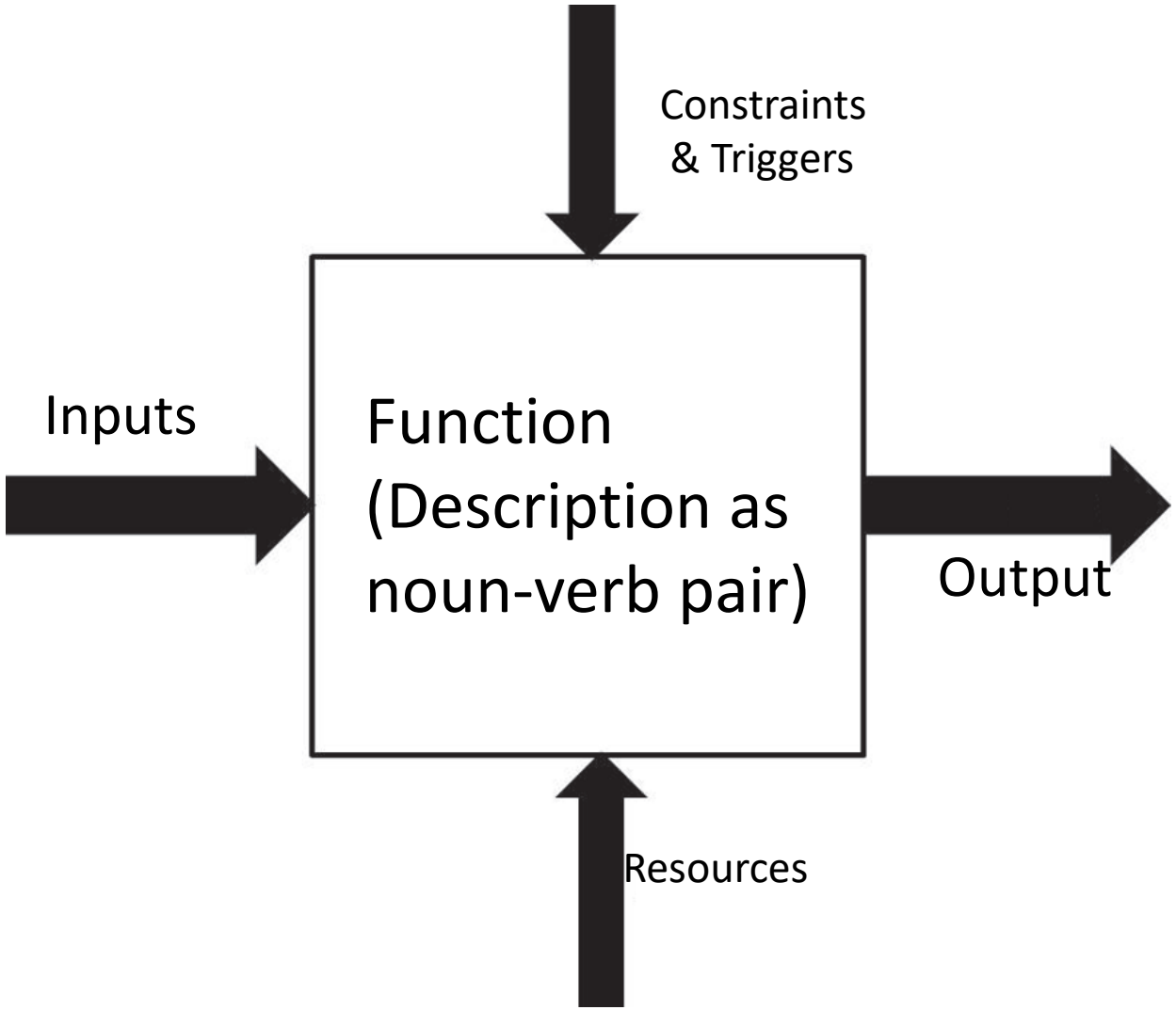
Fig. 2. Railway Intelligent Transportation Systems Architecture

Kumar N., Kumari N. (2012) Conceptual Architectural Design of Indian Railway Intelligent Transportation Systems. In: Vinel A., Mehmood R., Berbineau M., Garcia C.R., Huang CM., Chilamkurti N. (eds) Communication Technologies for Vehicles. Nets4Cars/Nets4Trains 2012. Lecture Notes in Computer Science, vol 7266. Springer, Berlin, Heidelberg

- **Selected Artifacts Created during the Architecture Process**
- Define a **consistent logical architecture**—capture the logical sequencing and interaction of system functions or logical elements.
- **Partition system requirements** and allocate them to system elements and subsystems with associated performance requirements—evaluate off-the-shelf solutions that already exist.
- **Evaluate alternative design solutions** using trade studies.
- **Identify interfaces and interactions** between system elements (including human elements of the system) and with external and enabling systems.
- Define the **system integration strategy** and plan (to include human system integration).
- Document and maintain the architectural design and relevant decisions made to reach agreement on the baseline design.
- Establish and maintain the traceability between requirements and system elements.
- Define verification and validation criteria for the system elements.
-

functional analysis and decomposition - list of tools and diagrams

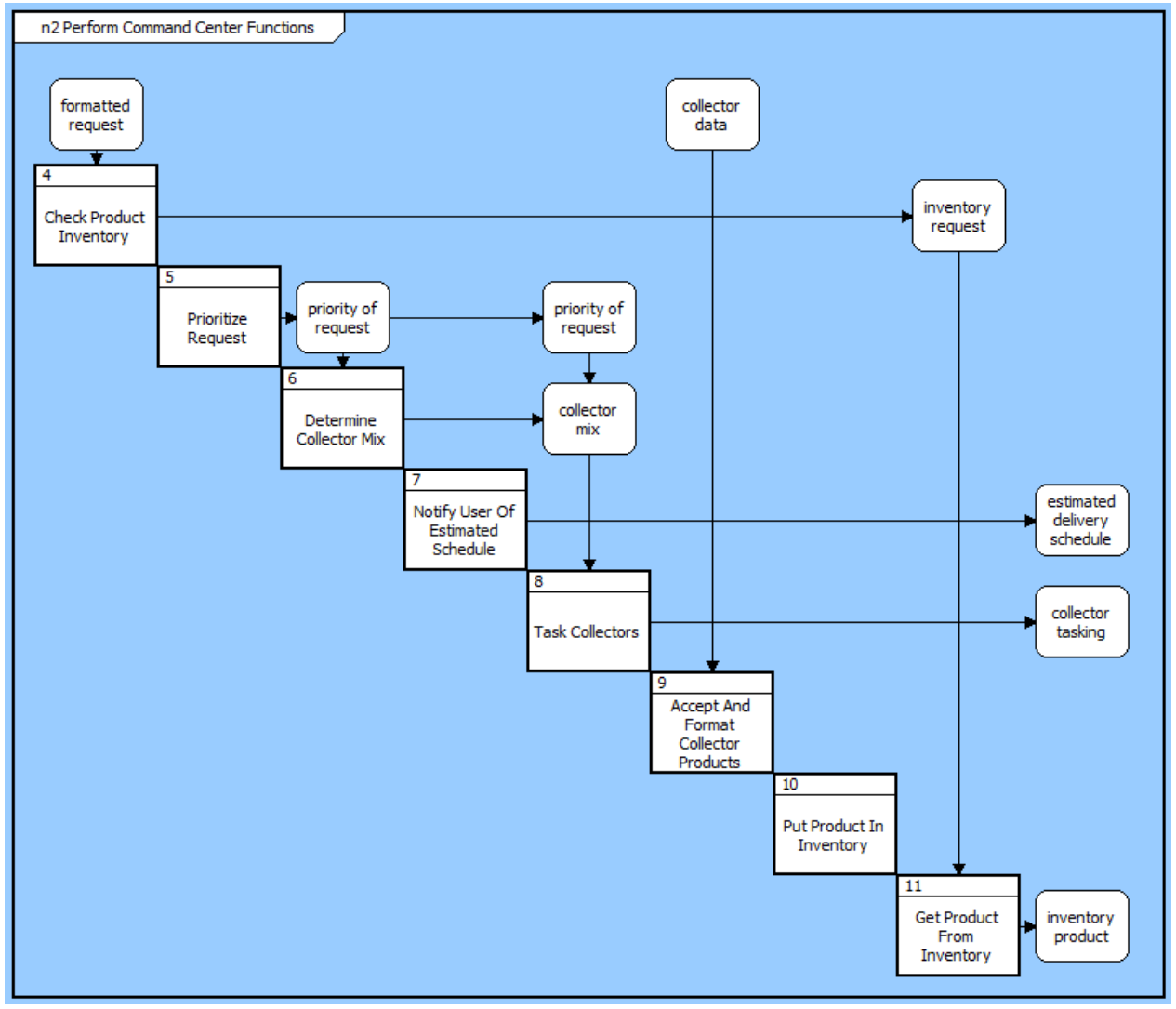
- IDEF0 diagram
- Functional flow block diagram (FFBD)
- N^2 diagrams - diagram represents the logical data flow for a system or system segment.
- Timeline analysis
- Tree diagrams
- SysML (such as activity diagrams, sequence diagrams)



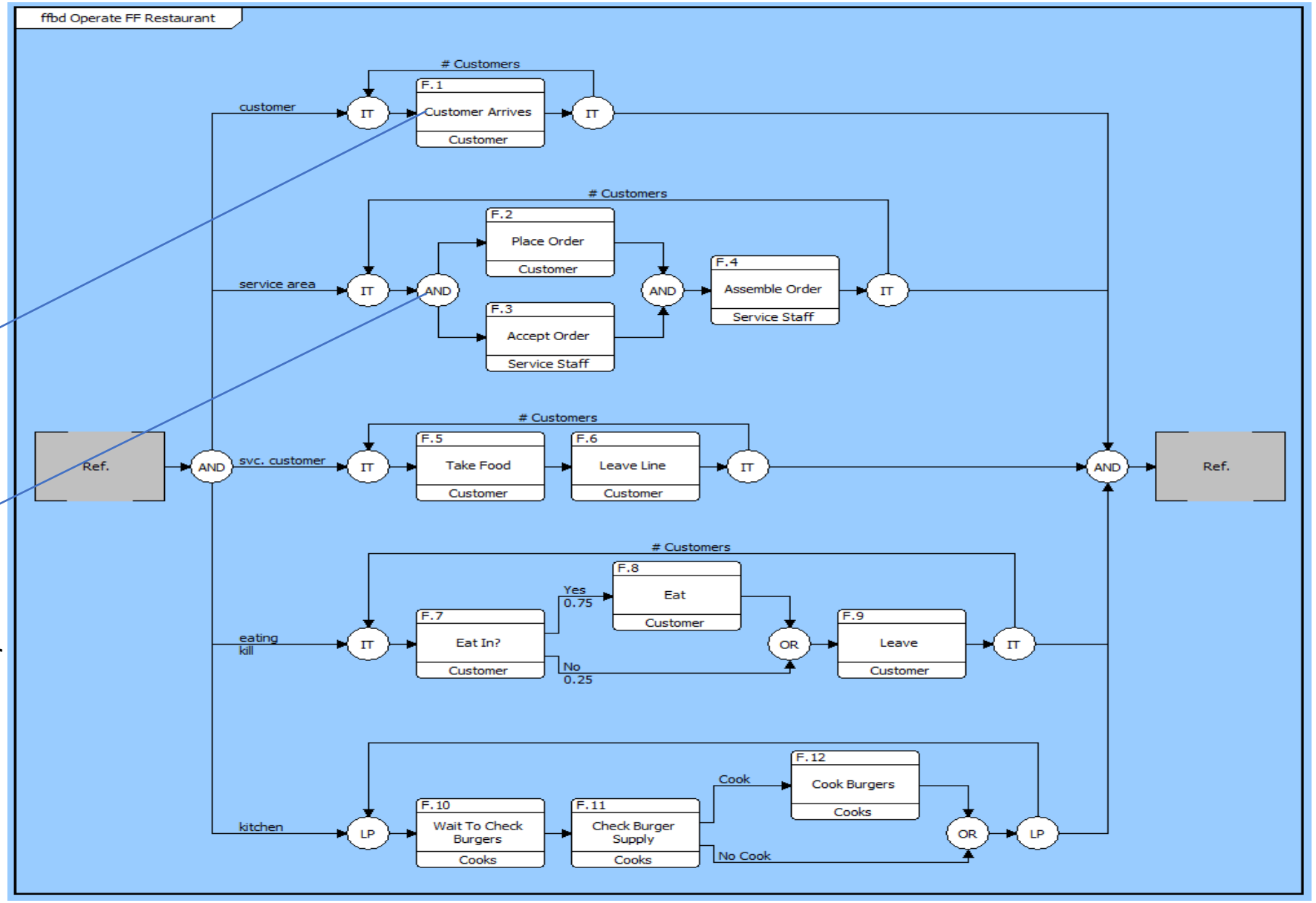
Clean Dirty
Kitchen
Items

IDEF0 diagram

N^2 diagram


n2 Perform Command Center Functions
formatted request
collector data
4
Check Product Inventory
inventory request
5
Prioritize Request
priority of request
priority of request
6
Determine Collector Mix
collector mix
7
Notify User Of Estimated Schedule
estimated delivery schedule
8
Task Collectors
collector tasking
9
Accept And Format Collector Products
10
Put Product In Inventory
11
Get Product From Inventory
inventory product

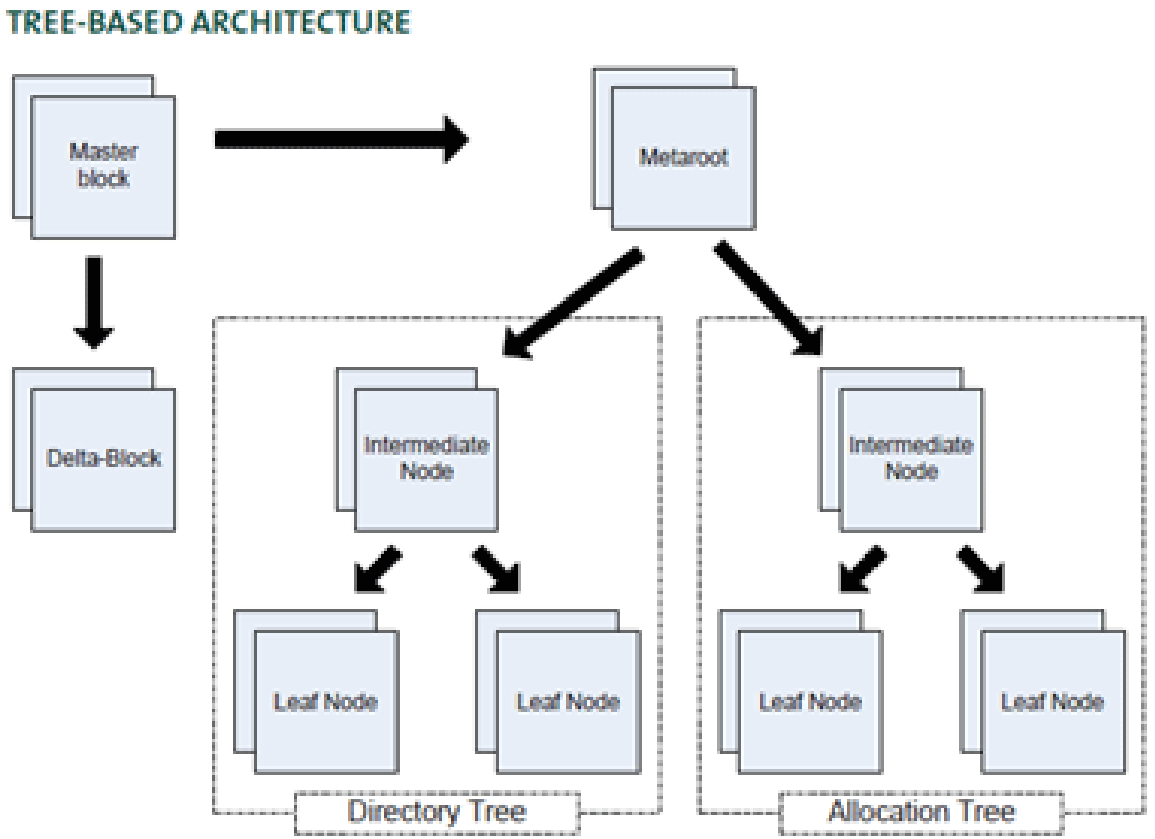
Functional flow block diagram (FFBD)



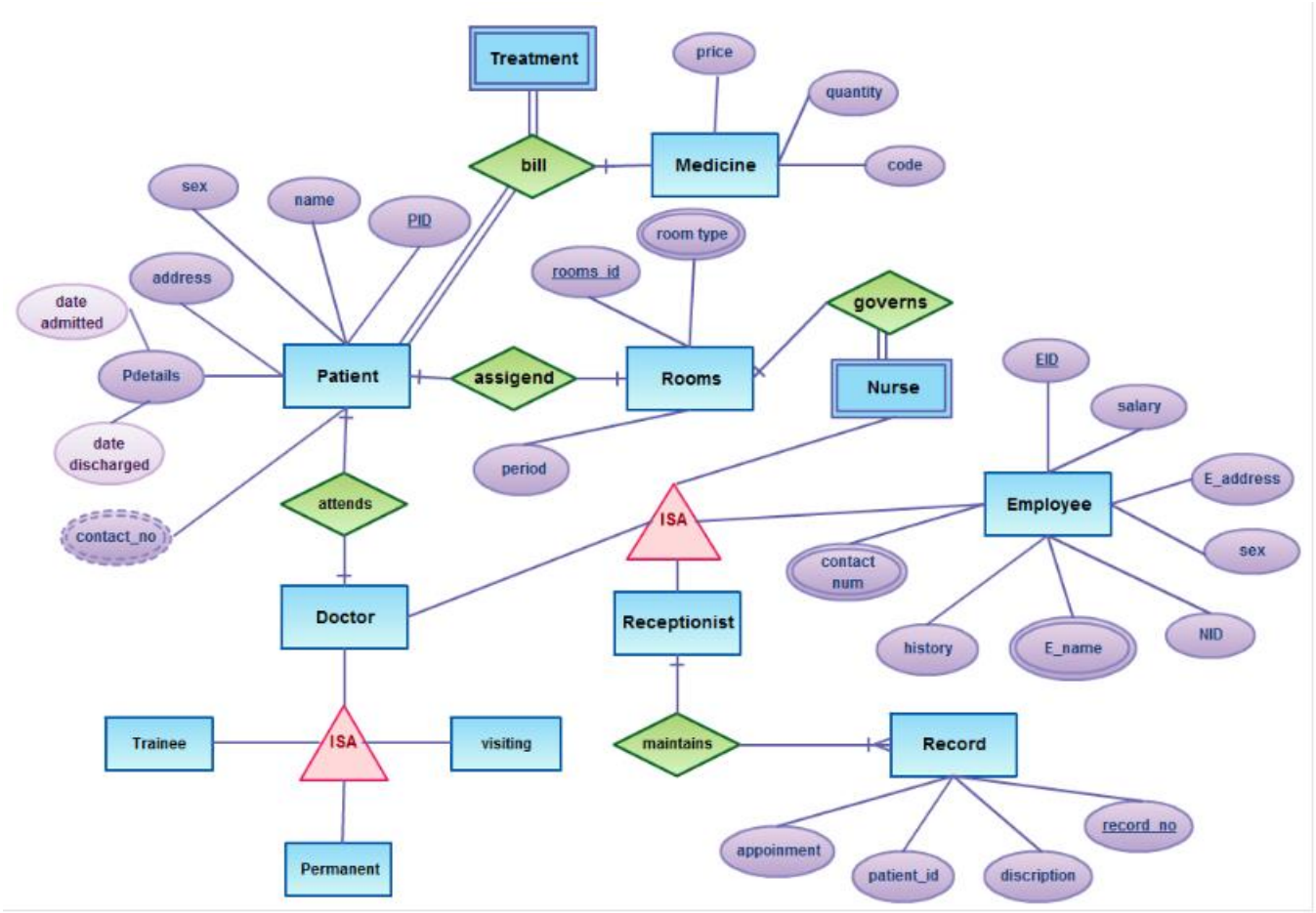
Functions

control constructs –
the building blocks of behavior

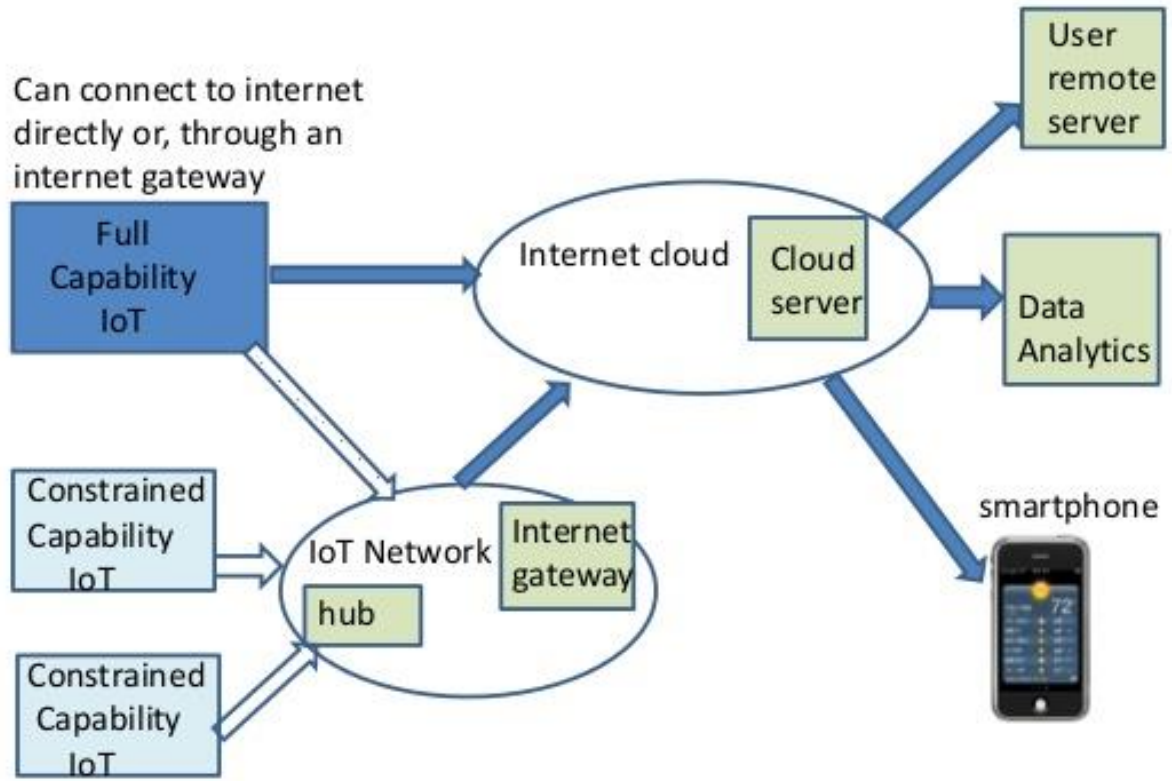
Tree diagrams



Entity Relationships



Simplified IoT System Architecture



context diagram

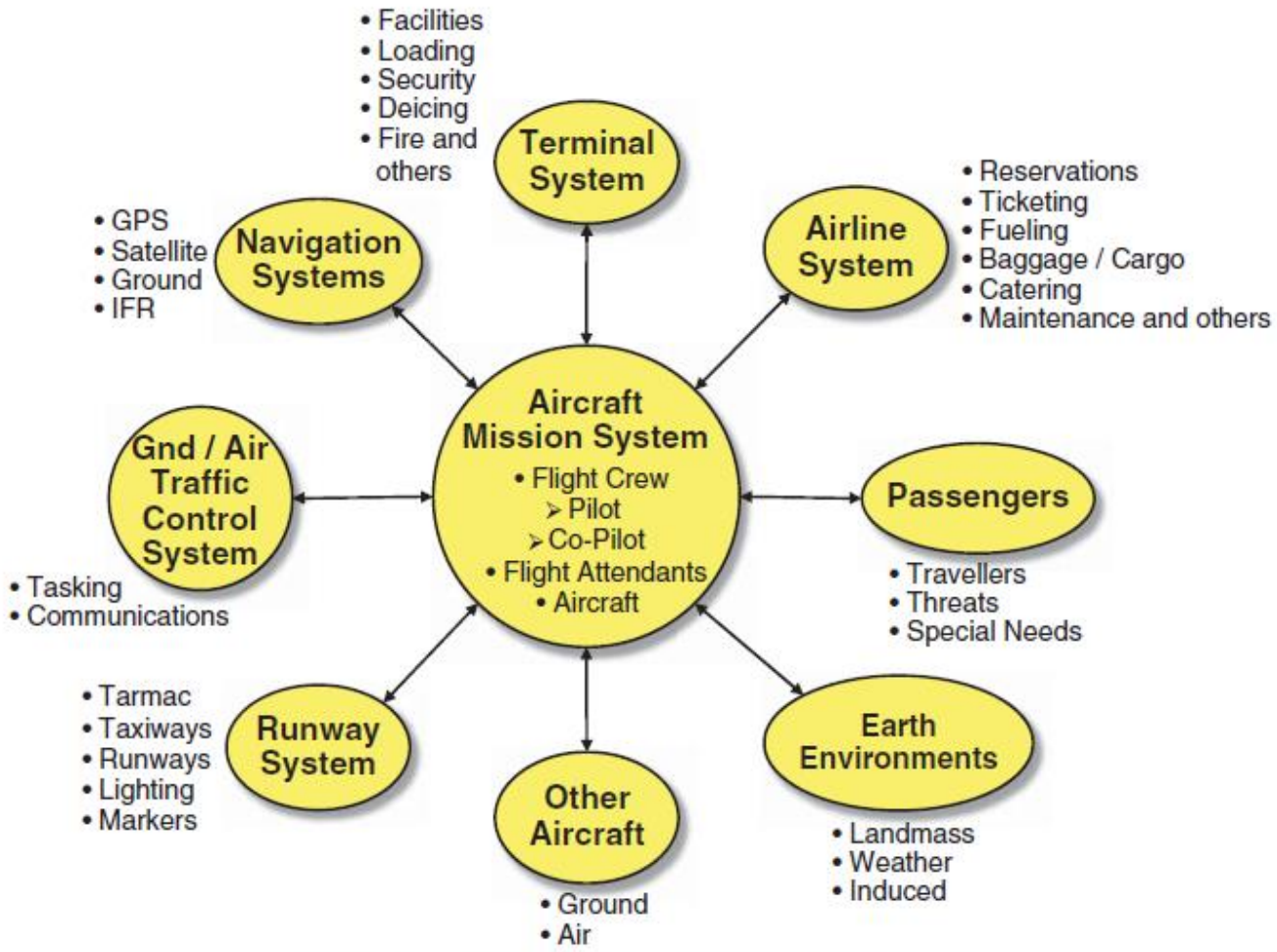


Figure 8.1 Context Diagram for an Aircraft Mission System

Source: Systems Engineering by Wasson