Massachusetts Institute of Technology

Architecture of Complex Systems
WEEK 2: FUNCTION AND EMERGENCE

Key Takeaways

This week's central themes were function, emergence, and documentation.

1. The **whole product system** is compromised of the product system and accompanying product systems, where the architect is both responsible and accountable for the whole product system. Additionally, the architect can identify the system boundary and interfaces for the system in the whole product system.

2. **Function** is what the system is built for. It consists of the process + the operand. A ***process*** is generally creating, destroying, or changing something. The ***operand*** is what is being altered by the process. OPM is a conceptual modeling language used to overlay function onto the representation of form.

3. In the initial stages of design, **functional analysis** is a fundamental tool that allows the team to understand the underlying functions and their interactions. The functional architecture includes these relationships between the processes and operands.

   Additional key concepts regarding function:

   - Primary externally delivered function
   - Internal functions

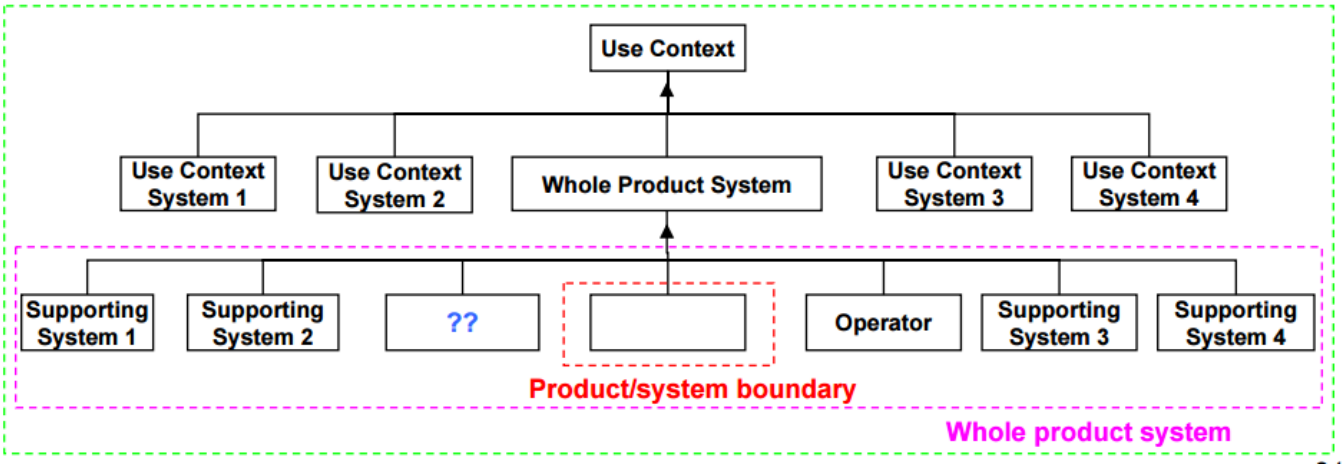
4. **System Architecture** maps function to the elements of form. Furthermore, it defines the relationships among these elements and their environment.

5. **Documentation** is used to capture experience and the vision of the system as well as to share experience. Several failure modes of documentation exist. Some limitations include change propagation and change request tracking.

Following this discussion on form and function, next week's central theme will be system architecture.

Copyright © 2017. Massachusetts Institute of Technology. All rights reserved.

Product System>Whole Product System and System Boundary>



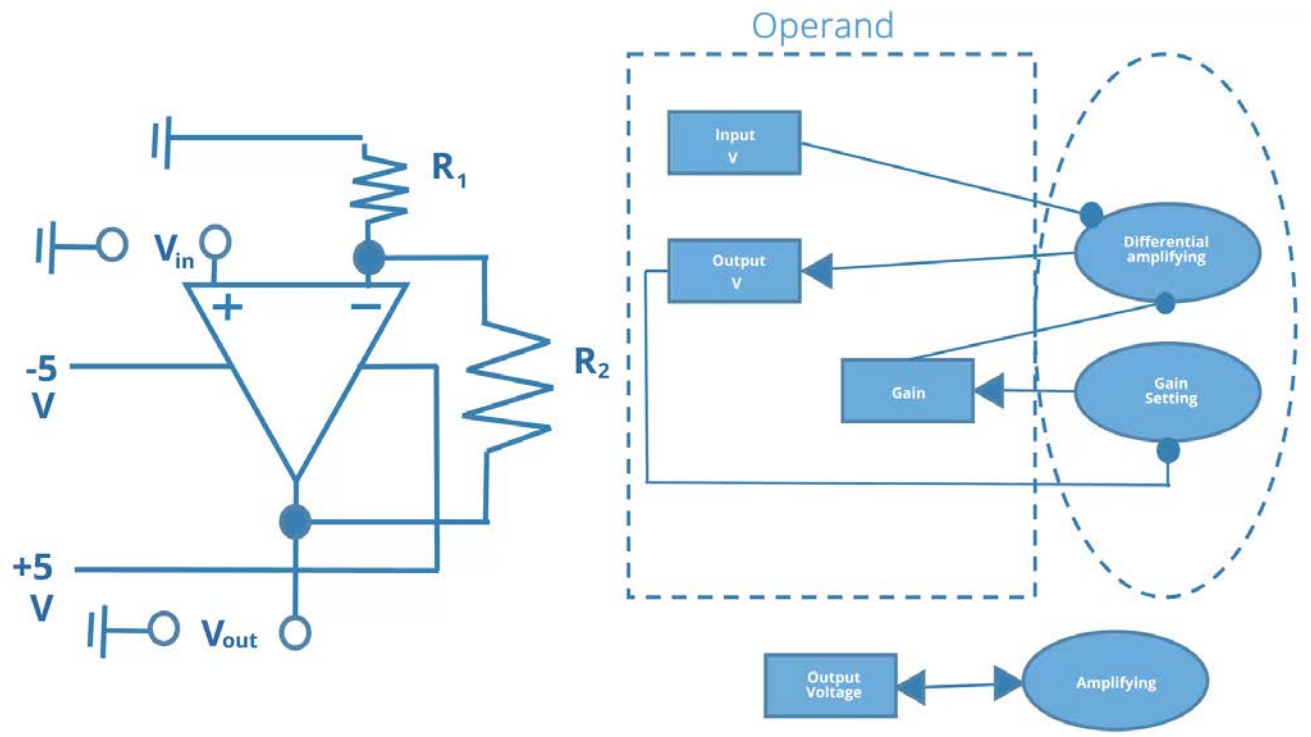
Function>What Is Function?>

FUNCTION VS. FORM

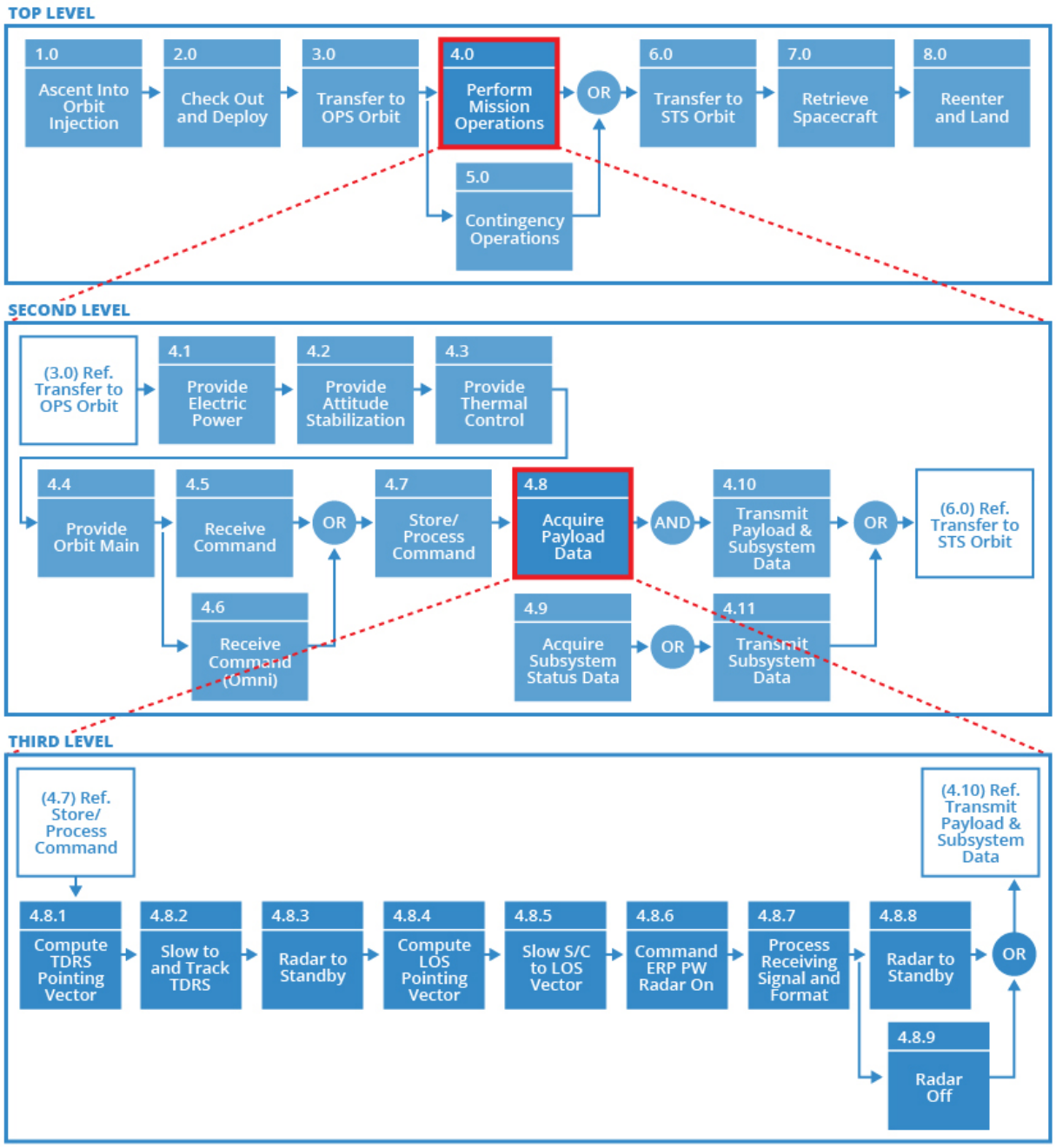
Form:	Function:
What a system is - Noun	What a system does - Verb
Objects + Formal Structure	Operands + Processes
Aggregates (and Decomposes)	Emerges (and Zooms)
Enables function	Requires instrument of form
Specified at an interface	Specified at an interface
Source of Cost	Source of External Benefit
When transaction is a good	When transaction is a service

Copyright © 2017. Massachusetts Institute of Technology. All rights reserved.

Function>Function and Form on One Diagram>



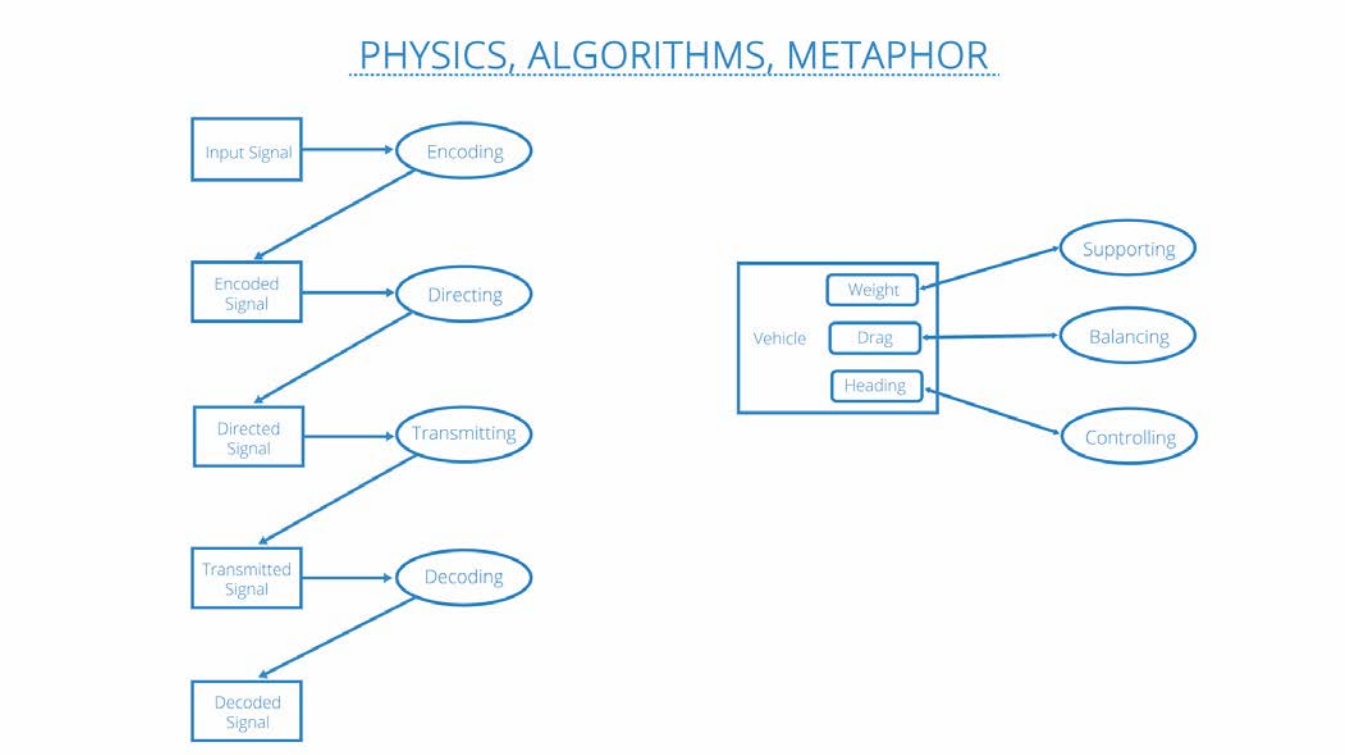
Copyright © 2017. Massachusetts Institute of Technology. All rights reserved.



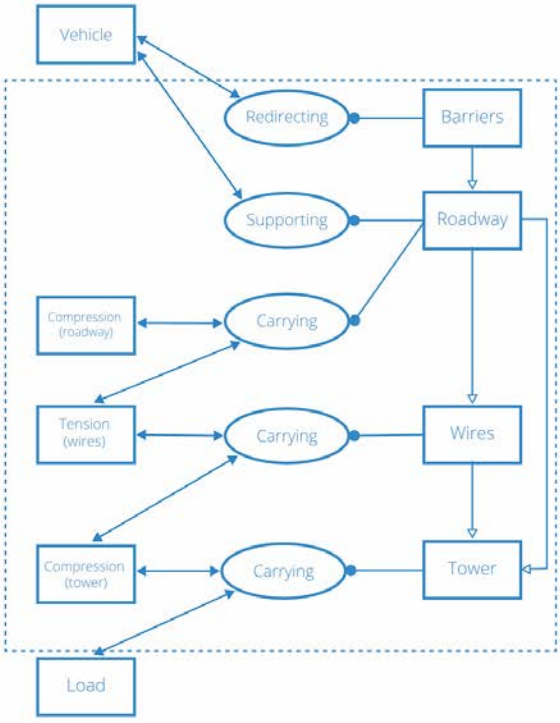
Source: NASA/SP-2007-6105

Copyright © 2017. Massachusetts Institute of Technology. All rights reserved.

Analyzing Function>Functional Analysis>



Architecture as Form to Function Mapping >Architecture as Form to Function Mapping>



Copyright © 2017. Massachusetts Institute of Technology. All rights reserved.