

# Mastering Systems Integration; Systems of Systems

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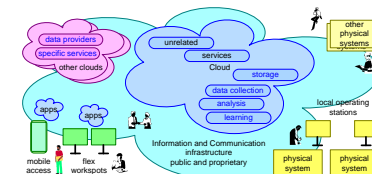
## Abstract

Most end-user functionality and services are realized by Systems of Systems. Many of these systems may include organizations and humans; the systems aren't technical artifacts anymore. These systems evolve over time individually and typically lack a centralized governance. The resulting end-to-end qualities depend on all constituent systems and their interoperability.

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# Types of Systems of Systems

**Directed** - The SoS is centrally managed

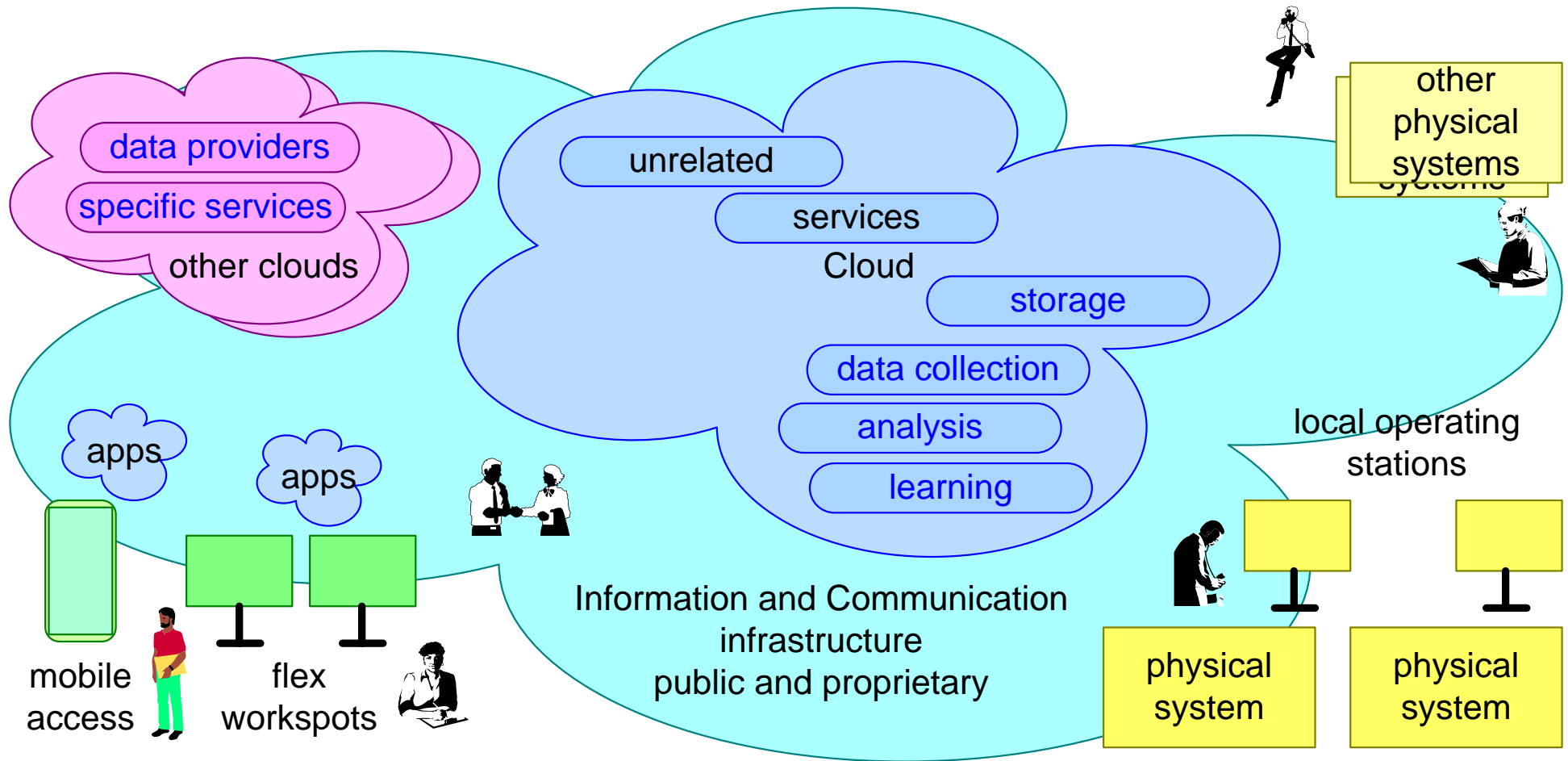
**Acknowledged** - The SoS has recognized objectives, and active cooperation between SoS and constituent systems

**Collaborative** - The constituent systems and stakeholders cooperate

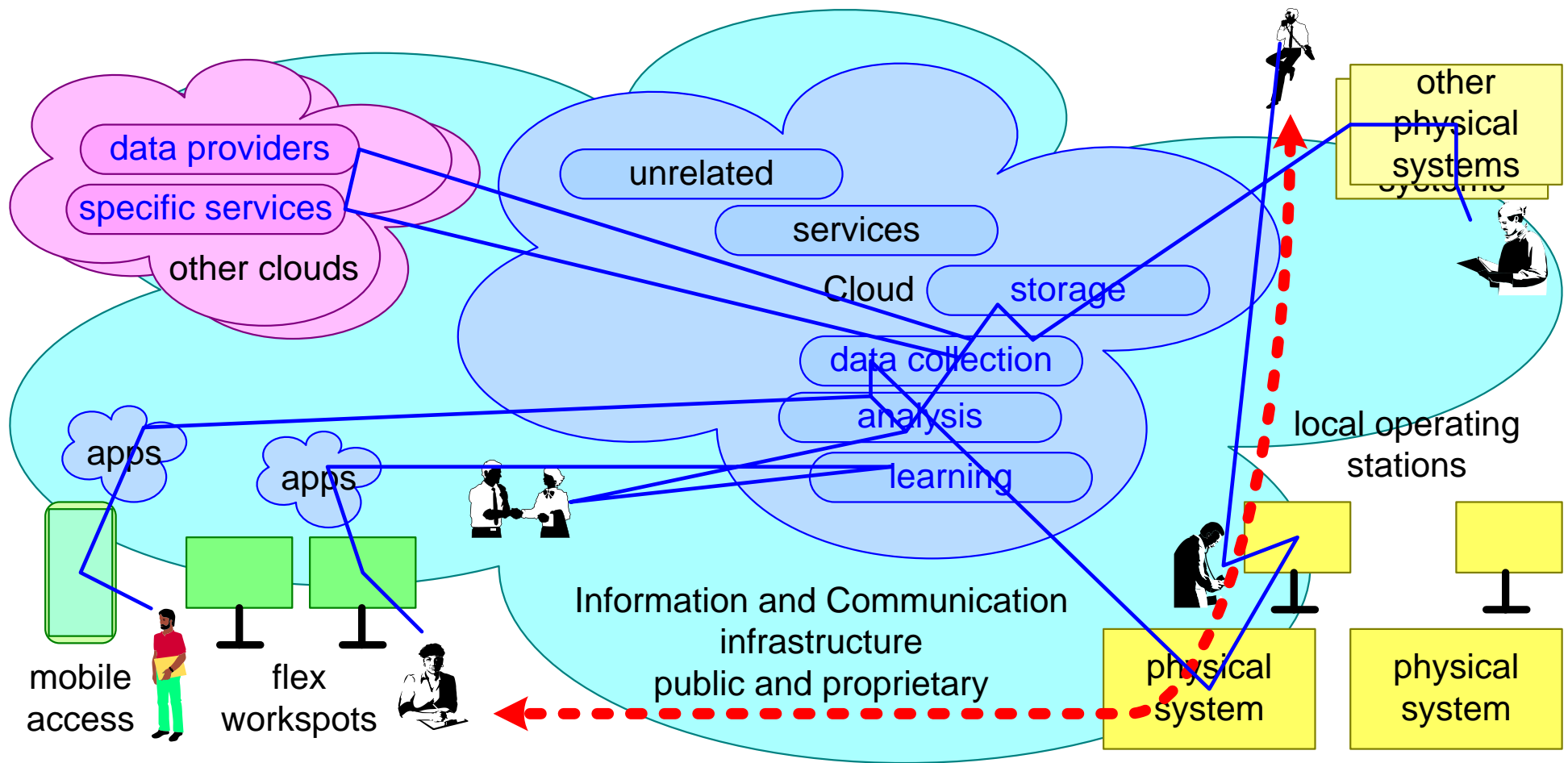
**Virtual** - The SoS nature more or less emerge from the constituent systems

**J. Dahmann and K. Baldwin.** 2008. "Understanding the Current State of US Defense Systems of Systems and the Implications for Systems Engineering." IEEE Systems Conference 2008 in Montreal, 2008

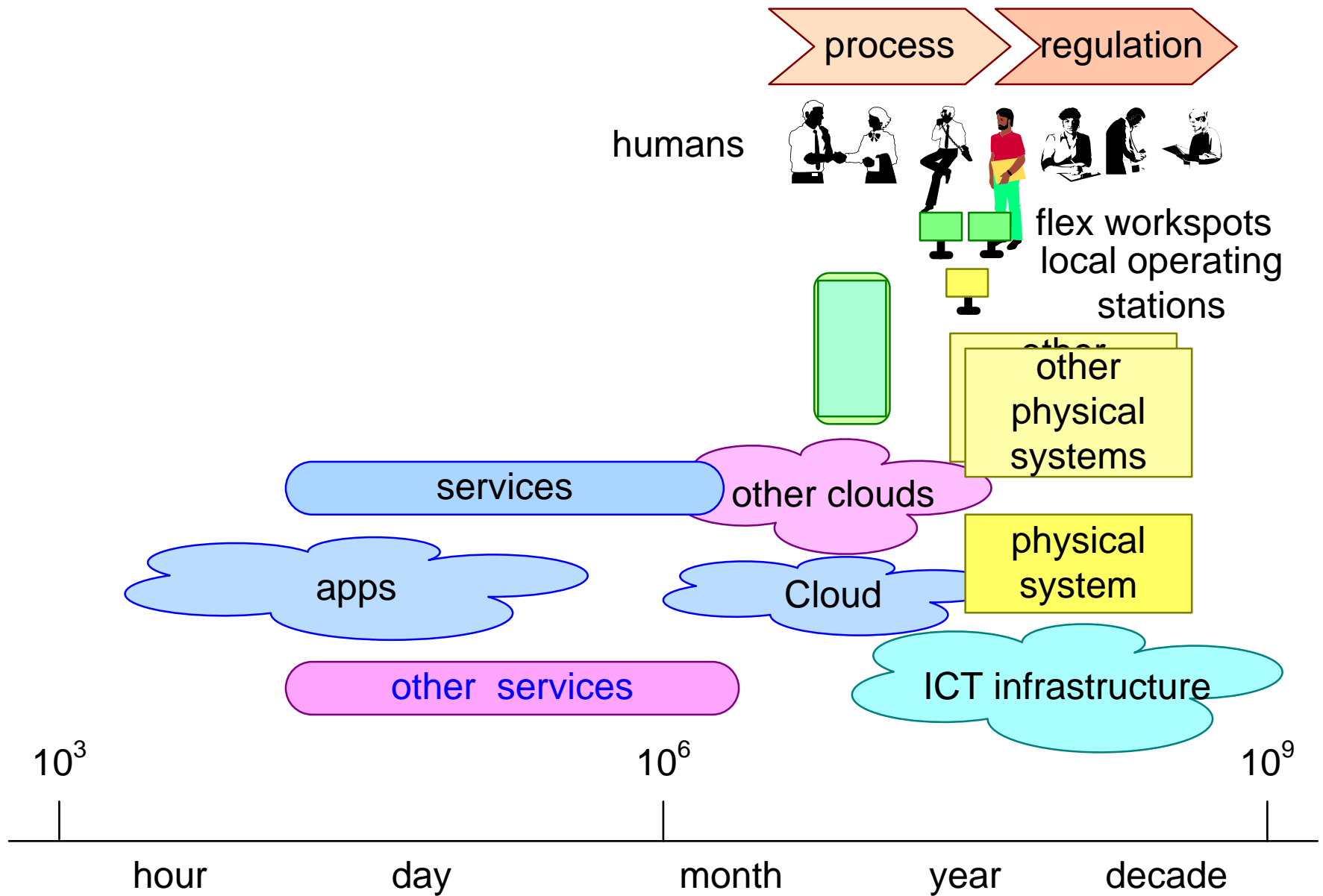
# Where are the System Boundaries?



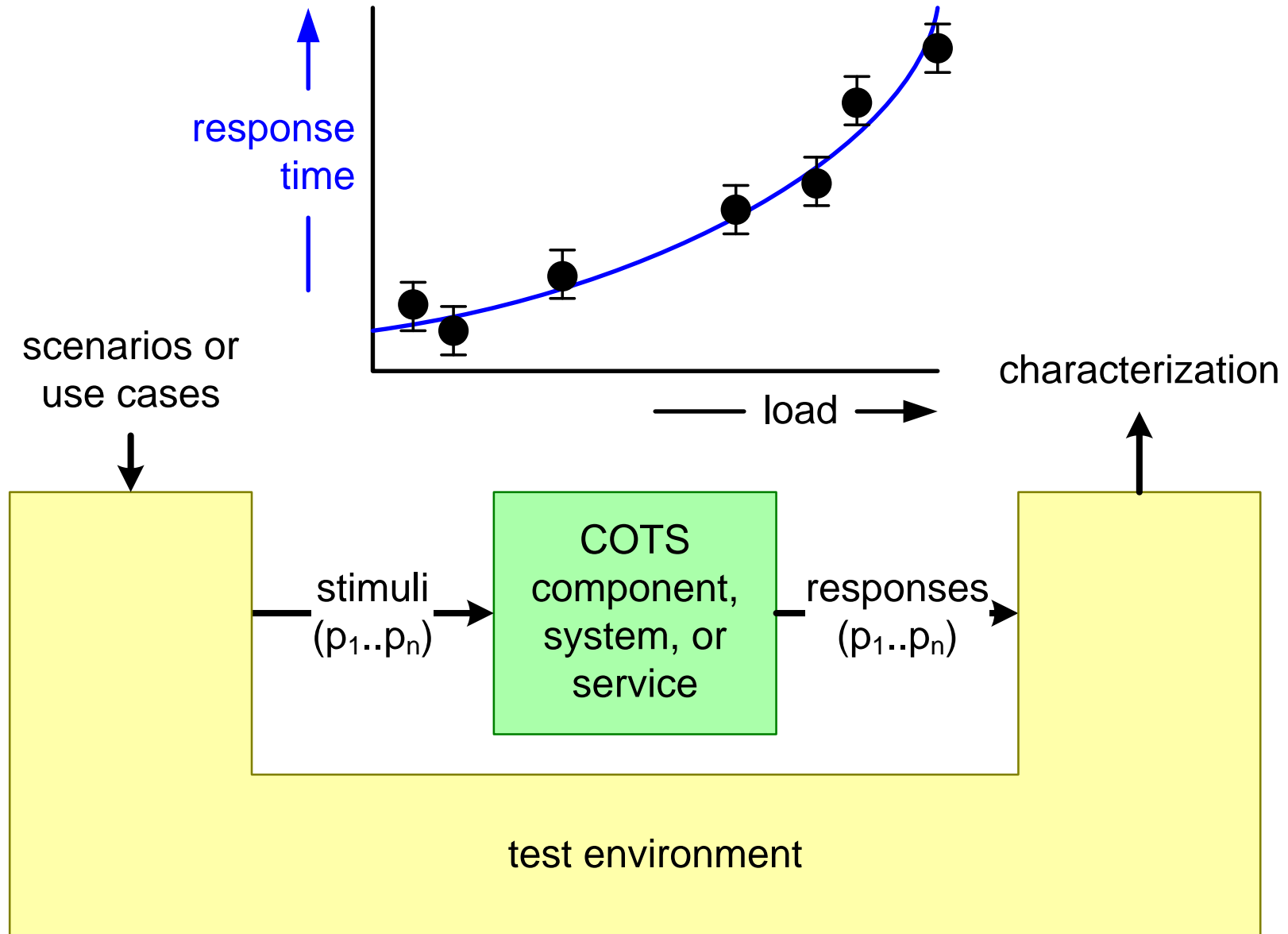
# End-to-End Function



# Varying Dynamics



# Characterization of Black Box Parts



# Summary

- Systems of Systems Integration **continues in the field** during operation
- **Ownership** and **responsibility** for end-to-end performance is **ill-defined**
- **Your system** may be **blamed** for problems with a **root cause elsewhere**
- End-to-end performance depends on a mix of
  - traditional **technical** systems
  - **modern technologies** like learning
  - **humans** in their organizational and societal context (psychological, social, political, economical, legal, etc.)
  - the **physical** context (location, climate, etc.) and laws of physics