What You Always Wanted to Know About the Right-Hand Side of the Vee and Never Dared to Ask

SWISSED 2022

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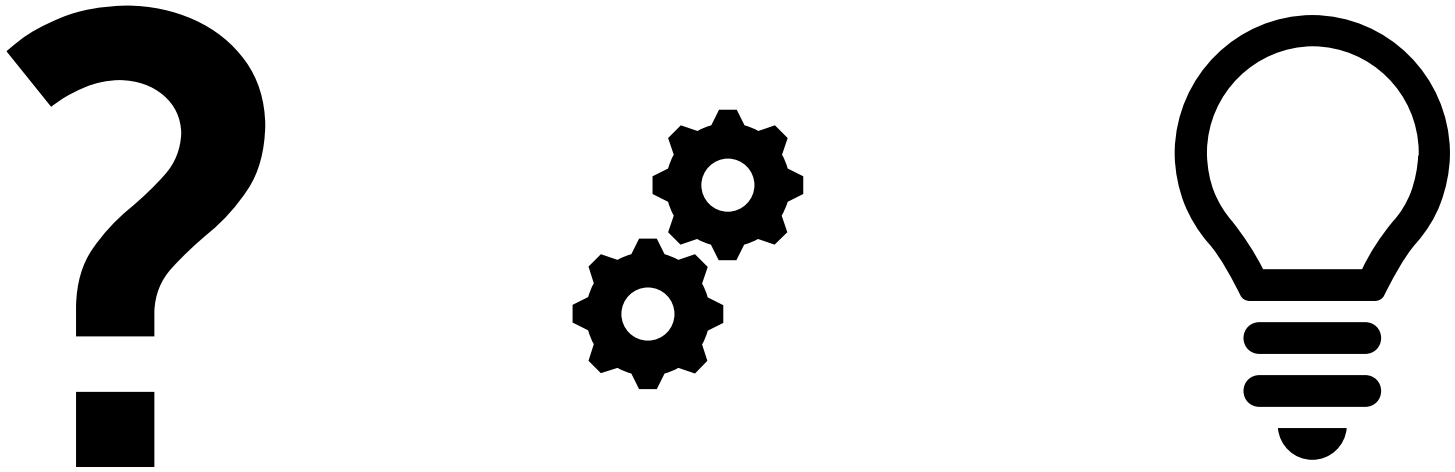
Introduction

- Current Assignment:
  - Systems Engineering Consultant – Freelancer
  - Independent member of oose Innovative Informatik eG
- Work Experience: 20 Years Industry Experience
  - INCOSE Technical Director (2019 – 2020)
  - DIN representative in ISO JTC 1 / SC 07 / WG 07 (Software and systems engineering – Life cycle management)
  - Project Editor for ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 24748-2 next revisions
  - Co-Editor INCOSE SE Handbook v5
  - Project manager for translation of INCOSE SE Handbook v4 and v5
  - Accredited trainer for SE-ZERT® trainings
  - Consultant to companies from various industries, including aerospace, renewable energies, automotive, maritime
- Education:
  - Dr. rer. nat. (Physics) – University of Hamburg

From Design to Reality – Walking up the “Vee”



Zurich, we’ve had a problem…

Common Approaches

Generic life cycle (ISO/IEC/IEEE 15288:2015)

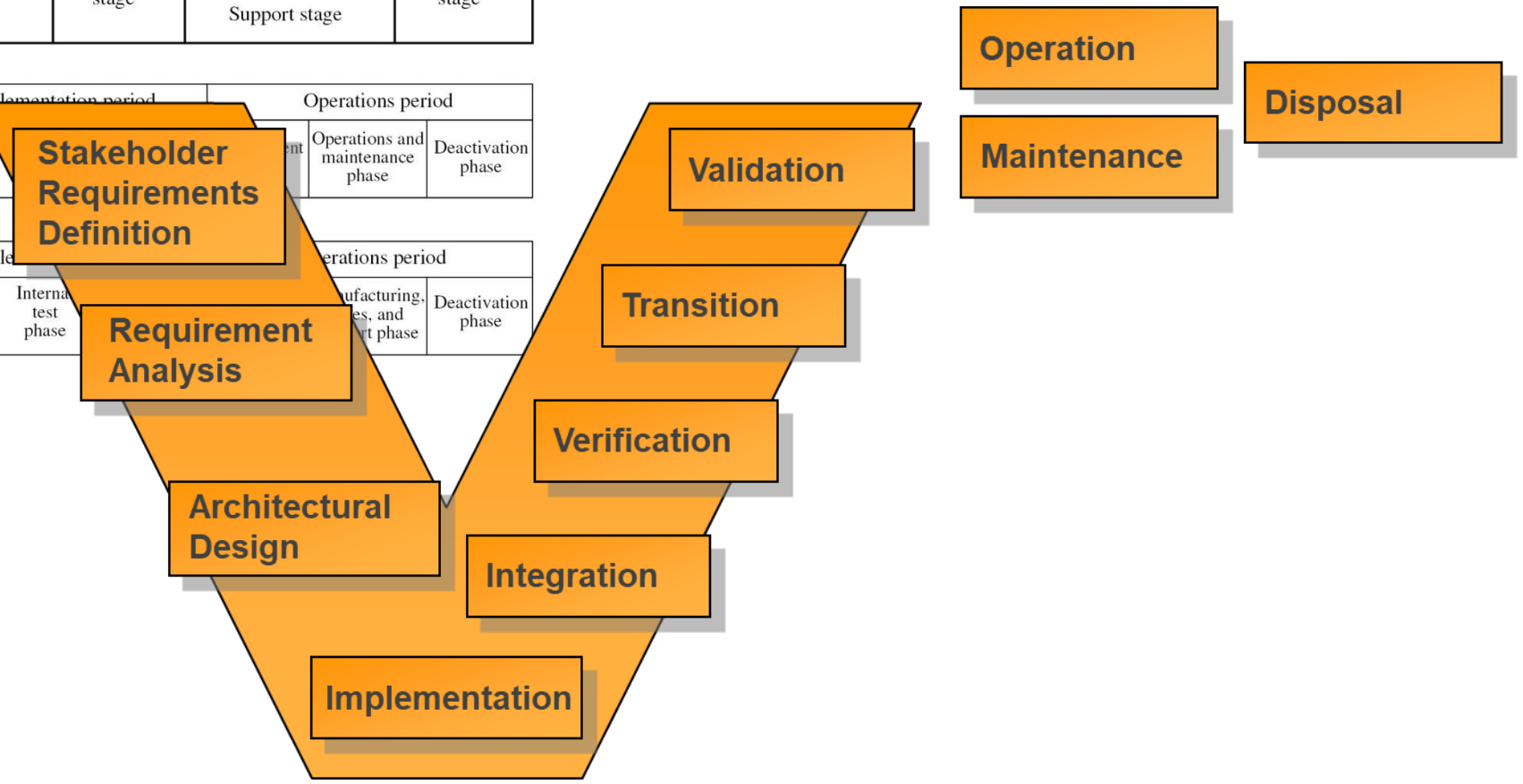
Concept stage	Development stage	Production stage	Utilization stage	Retirement stage
			Support stage	

Typical high-tech commercial systems integrator

Study period				Implementation period		Operations period	
User requirements definition phase	Concept definition phase	System specification phase	Acq prep phase	Source select. phase		Operations and maintenance phase	Deactivation phase

Typical high-tech commercial manufacturer

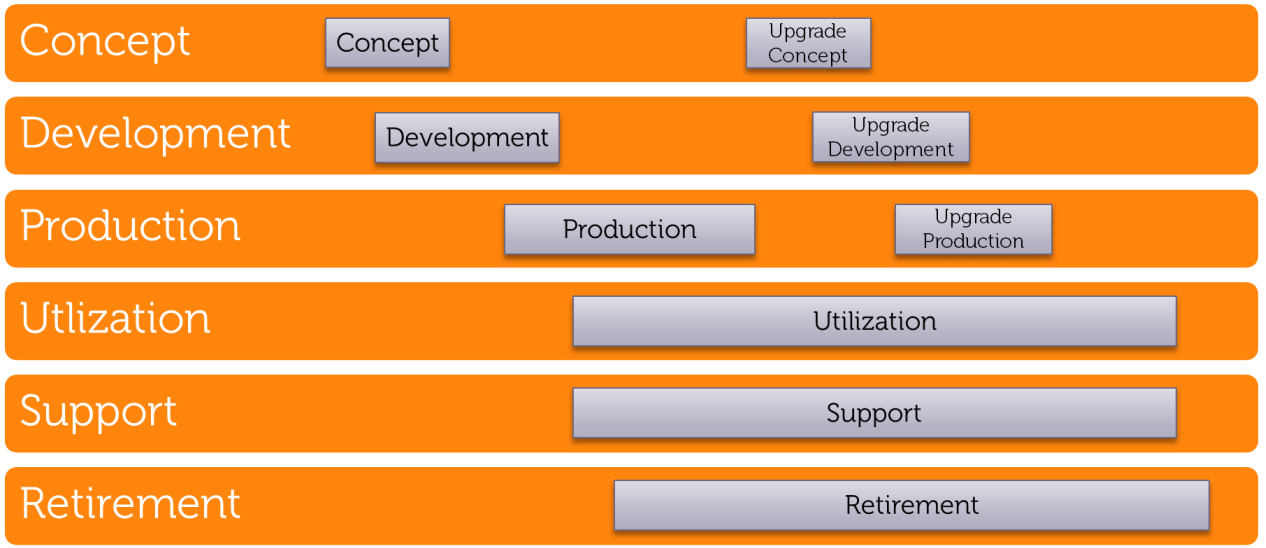
Study period			Implementation period		Operations period	
Product requirements phase	Product definition phase	Product development phase	Engr. model phase	Internal test phase	Manufacturing, ... phase	Deactivation phase



Source: INCOSE SEHv4, 2015

Reality

- Utilization and support stages begin with first unit
- For SW, support can occur during development
- Concept, development, and production can be re-started for mid-life upgrades or service life extensions
- Support can end while units are still being utilized
- Retirement begins when first unit retires



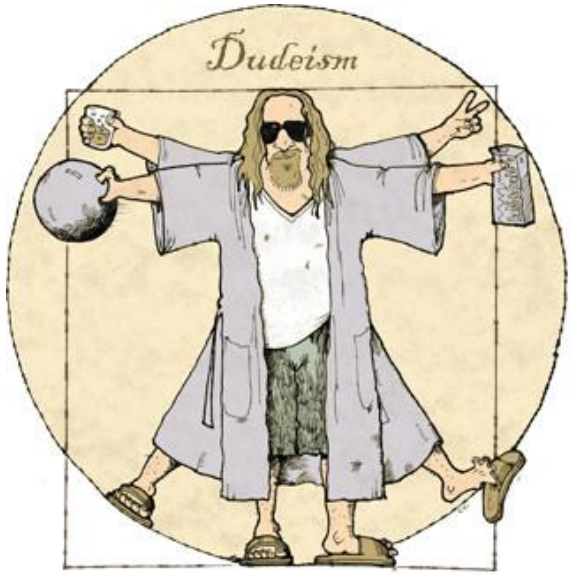
Implications

- When are you done with stakeholder requirement?
- When are you done with system requirements?
- When are you done with system analysis, modelling, and simulation?
- When are you done with system verification?

All processes run in parallel – There is no sequence

Your Process Landscape Is a System

- Improvements to a system can only be made when considering the whole
- Examples



Sources: https://www.123rf.com/clipart-vector/smart_home_technology.html, https://dudeism.com/, https://www.psg.fr/

System Realization Processes?

- Sometimes, implementation, integration, verification, transition, and validation processes are referred to as realization processes
- However,
  - Artefacts are verified (e.g., design verification)
  - Artefacts are integrated (e.g., 3D models)
  - Prototypes are implemented
  - System is transitioned several times (e.g., from design organization to manufacturer)
  - Artefacts are validated (e.g., SysML™ models)

Will be reflected in the next revisions of SE standards

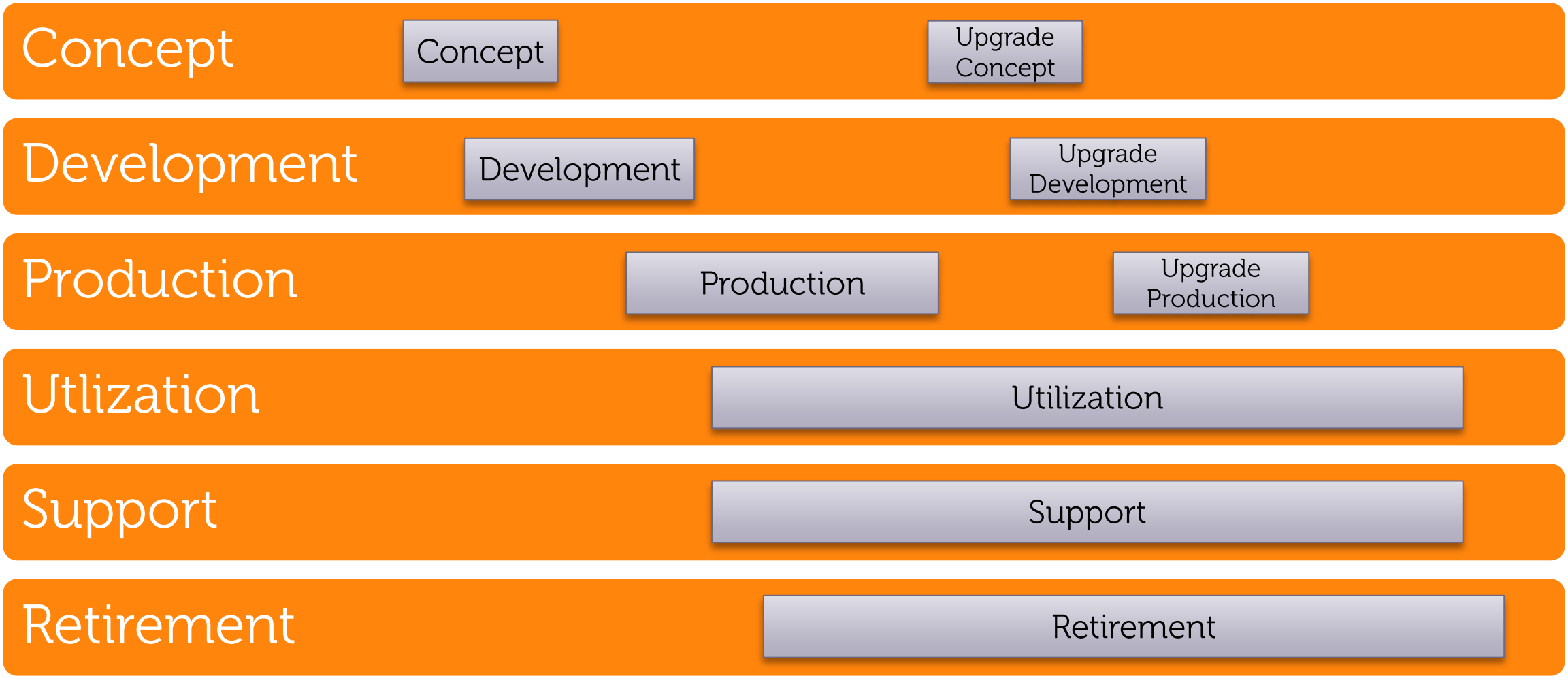
Recommendations

- See your process landscape as a system
  - Everything interacts with everything else
  - Everything goes somewhere
  - There is no such thing as a free lunch
  - Tool follows process follows purpose
  - “Thinking” is always in scope

Apply systems thinking and systems engineering to your work

Sources: https://www.evansopticalengineering.com/page00/sysenlaw.htm, ISO/IEC/IEEE 24748-2 next revision, INCOSE SEHv4

Thank you!


Concept
Concept
Upgrade Concept
Development
Development
Upgrade Development
Production
Production
Upgrade Production
Utlization
Utilization
Support
Support
Retirement
Retirement