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Healthcare Facility Commissioning – The Transition of Clinical Services

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What happens in commissioning?

We convert a building into a hospital.

What happens in commissioning?

But sometimes….

What happens in commissioning?

We convert a building into a hospital.

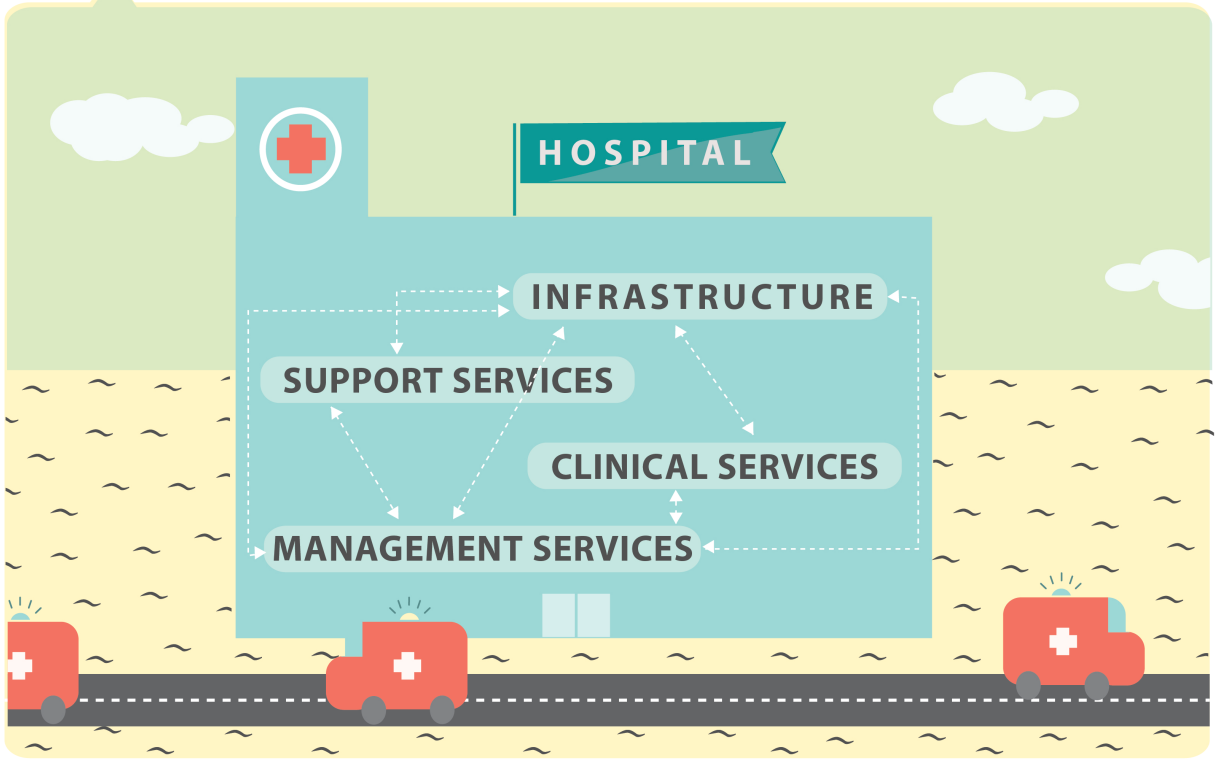
Inward

- Tangibles
  - Building
  - Equipment
  - Medication
- Intangibles
  - Management
  - Policies
  - skills

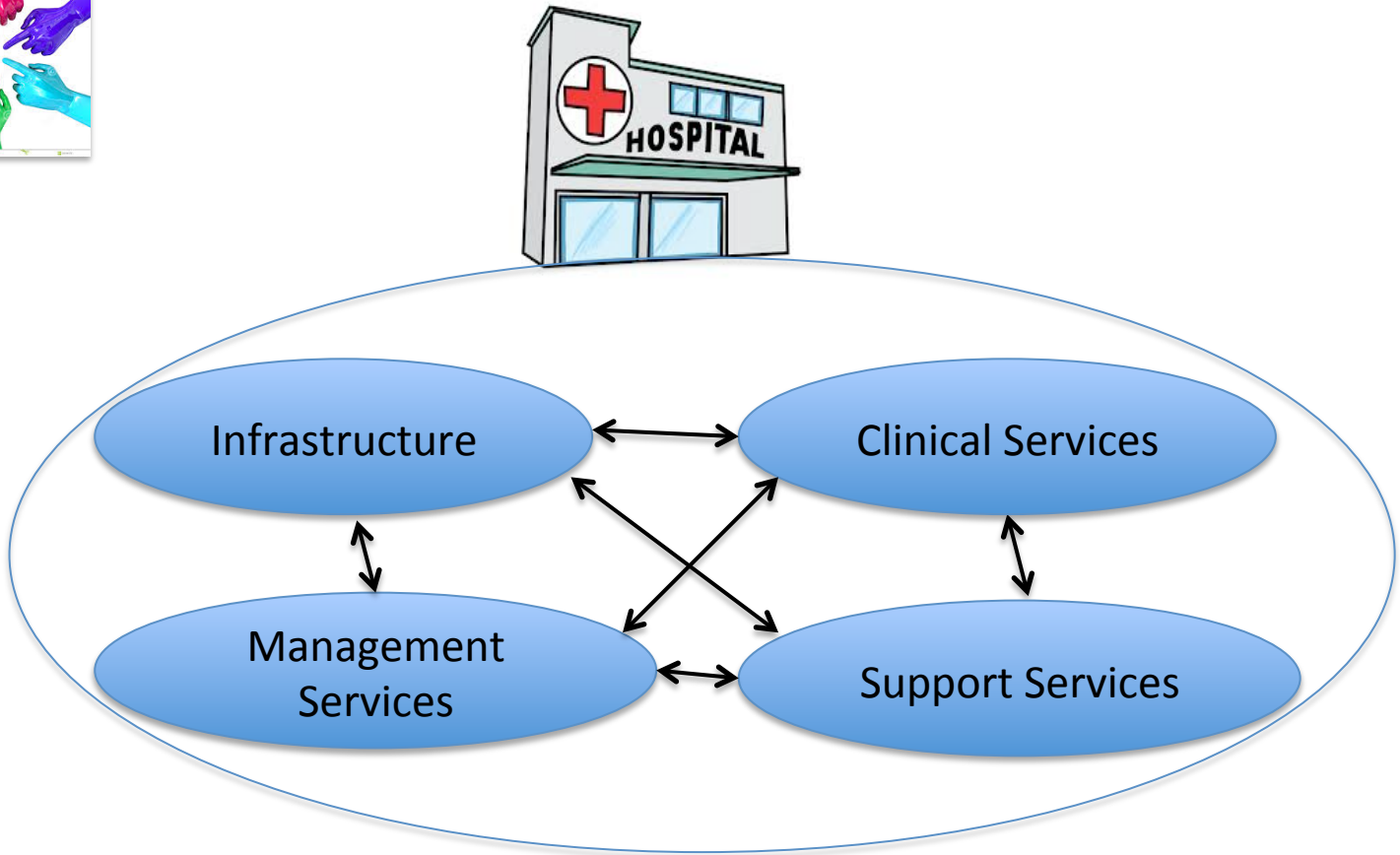
Outward

- In the Health System
  - EMS
  - Referral
  - Pathology service
- Outside the Health System
  - Financial System
  - Legal
  - Society

Hospital System



Inward


HOSPITAL
Infrastructure
Clinical Services
Management Services
Support Services

Hospital System Services Design

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- Multi-disciplinary hospital design should start with service blueprinting
  - to capture offered standard services packages prescribed national and local regulations for healthcare services delivery.
  - identifies the physical evidence for the service encounter together with the customer/patient actions and interaction with the onstage contact person

Hospital System Services Design (cont.)

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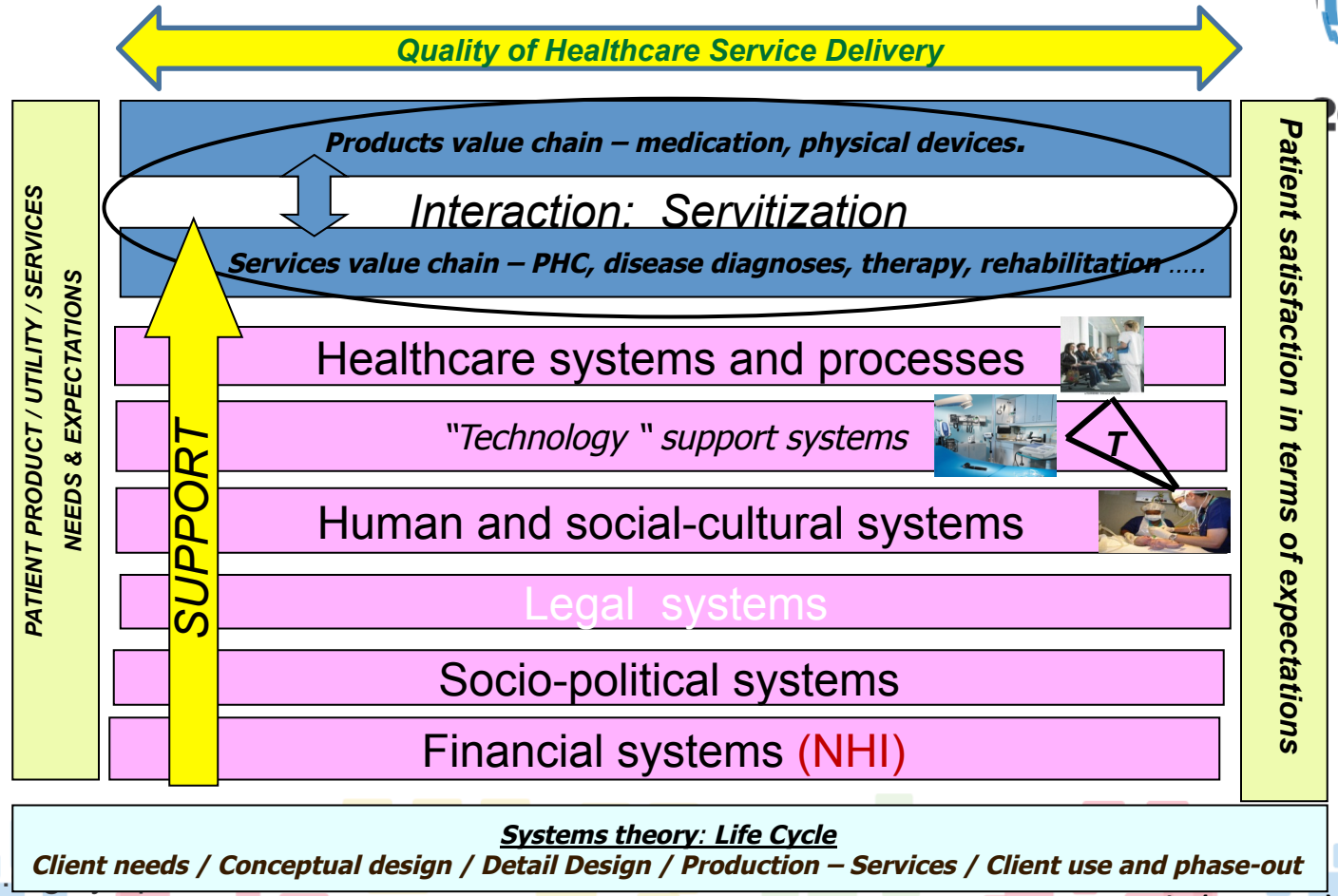
- service blueprinting
  - identifies the interactions with the backstage contact persons who connect over the line of internal interaction with support processes
  - important input for the architectural brief

AN OVERARCHING HEALTHCARE PRODUCT / SERVICES & SUPPORT SYSTEMS PERSPECTIVE



Source: Weeks (2012:385)

AN OVERARCHING HEALTHCARE PRODUCT / SERVICES & SUPPORT SYSTEMS PERSPECTIVE

Quality of Healthcare Service Delivery

Onstage

PATIENT PRODUCT / UTILITY / SERVICES NEEDS & EXPECTATIONS

Products value chain – medication, physical devices.

Interaction: Servitization

Services value chain – PHC, disease diagnoses, therapy, rehabilitation .....

SUPPORT

Healthcare systems and processes

"Technology " support systems

T

Human and social-cultural systems

Legal systems

Socio-political systems

Financial systems (NHI)

Patient satisfaction in terms of expectations

Systems theory: Life Cycle

Client needs / Conceptual design / Detail Design / Production – Services / Client use and phase-out

Source: Weeks (2012:385)

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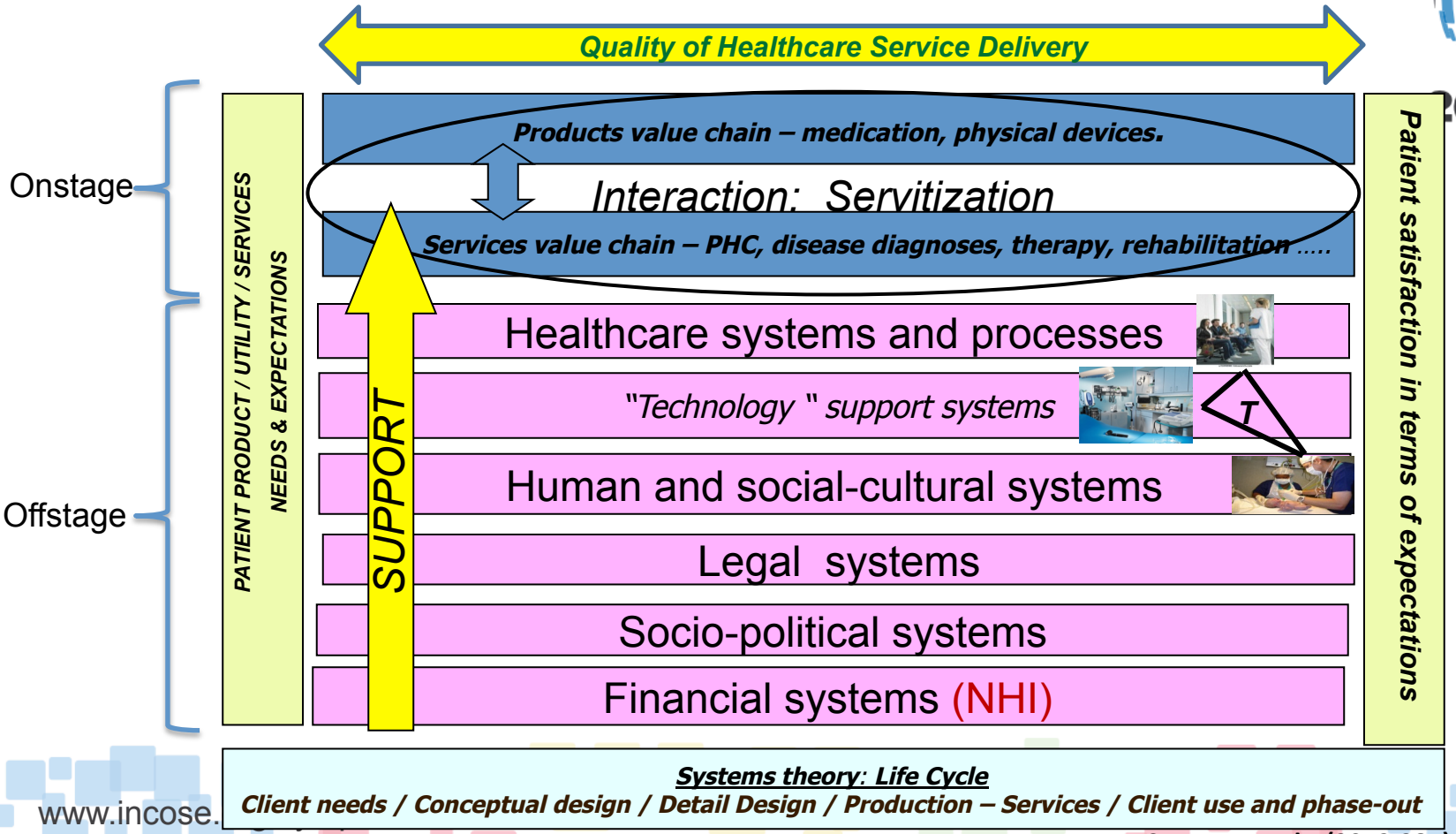

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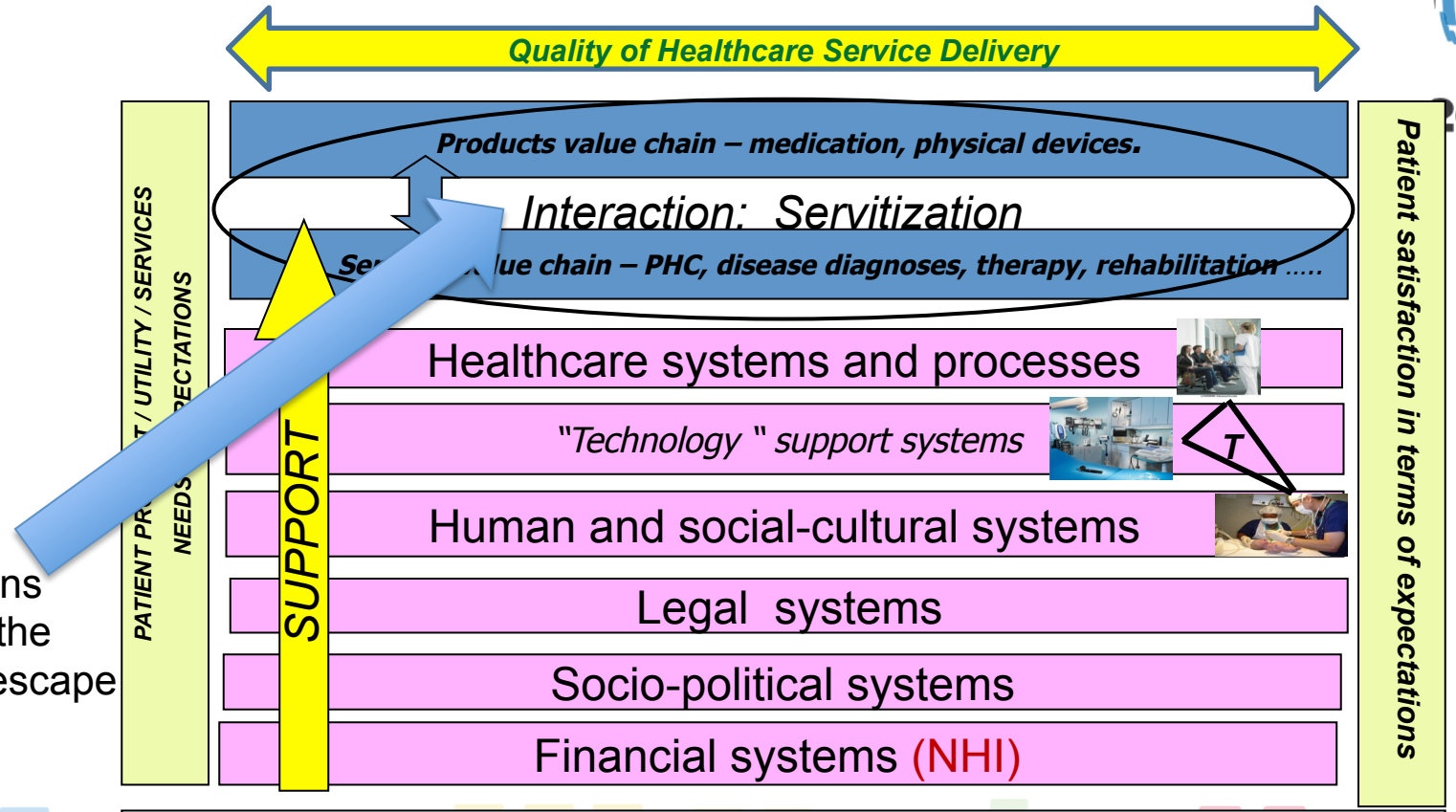


Happens within the servicescape

Systems theory: Life Cycle

Client needs / Conceptual design / Detail Design / Production – Services / Client use and phase-out

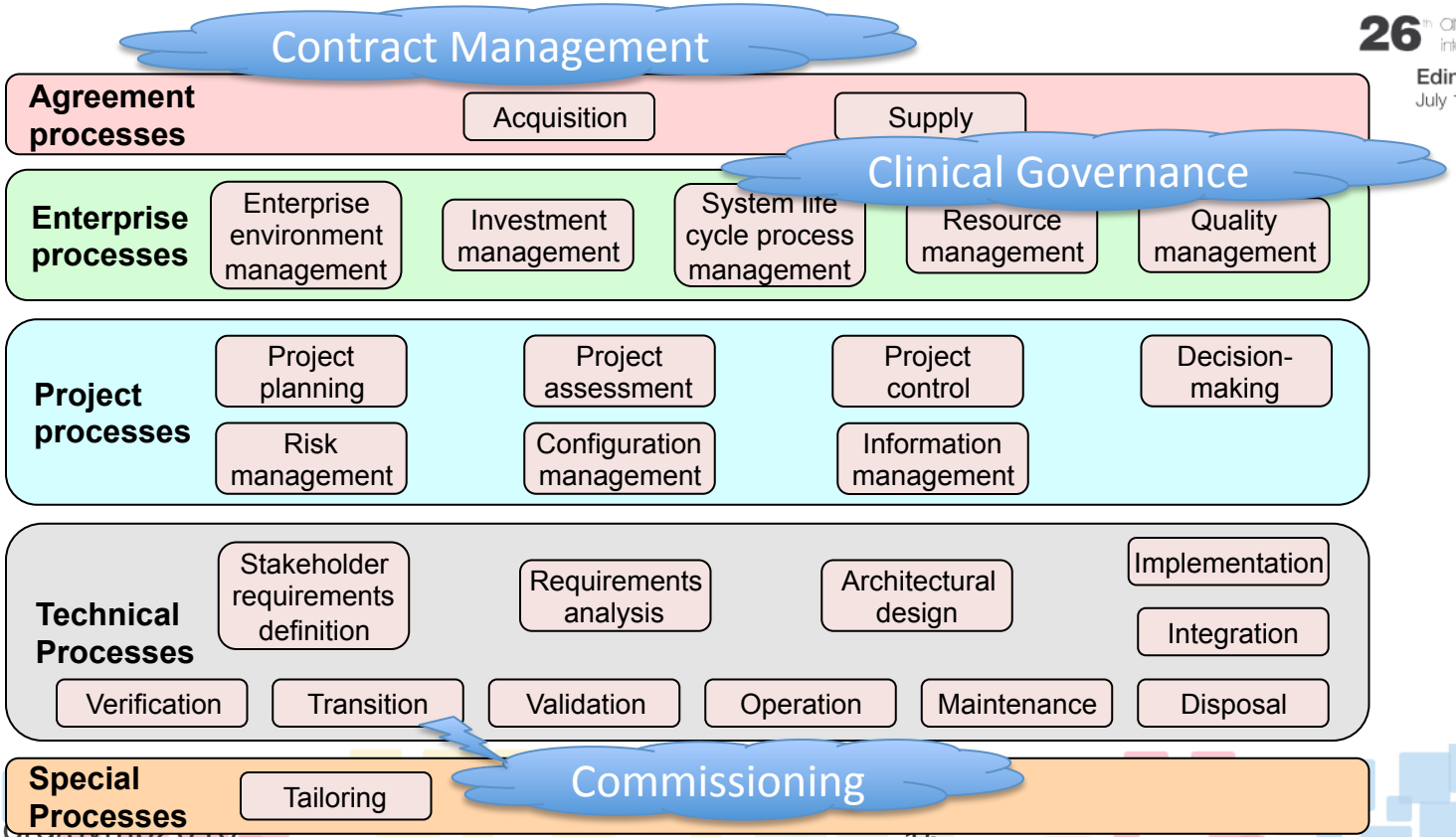
Source: Weeks (2012:385)

Service Scape

- Environmental Dimensions,
- Holistic Environment,
- Psychological Moderators,
- Internal Responses and Behavior

System Life Cycle Processes

ISO 15288 (Creating System)



Source: Adapted from L.D. Erasmus, PBMR

Transition Process

The purpose of the Transition Process is to establish a capability to provide services specified by stakeholder requirements in the operational environment.

This process is used at each level in the system structure and in each stage to complete the criteria established for exiting the stage

Ultimately, the Transition Process transfers custody of the system and responsibility for system support from one organizational entity to another.

Successful conclusion of the Transition Process typically marks the beginning of the Utilization Stage of the system-of –interest.

Source: INCOSE – SE Handbook V3

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Successful conclusion of the Transition Process typically marks the beginning of the Utilization Stage of the system-of –interest.

"Commissioning"

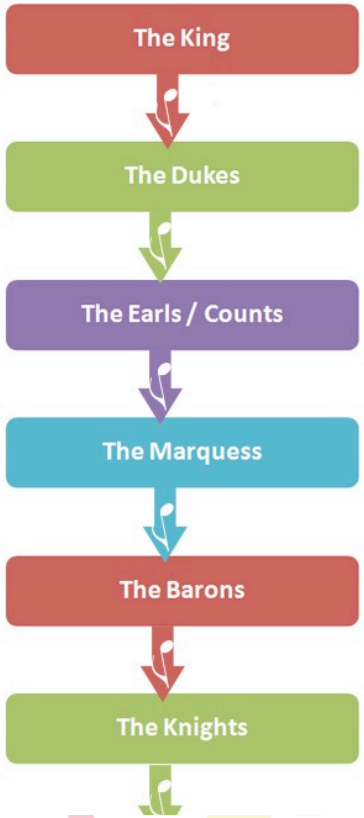
Source: INCOSE – SE Handbook V3

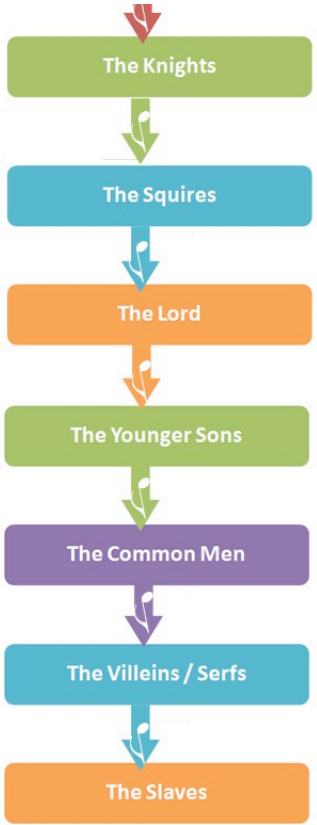
SE Tools to consider i.t.o. Commissioning

- System Hierarchy
- V-model
- Configuration Management
- Breakdown Structure Relationships
- Role players throughout the System Life Cycle

Source: INCOSE – SE Handbook V3

System Hierarchy





hierarchystructure.com

Source: INCOSE – SE Handbook V3

Level 1	Raw Material		Surgical stainless steel, etc.

Source: Adapted from De Waal & Buys (2007)

Figure 4. Systems Hierarchy for Healthcare

Level 2-4	Products		Medical Gas sub-system consisting out of a compressor, Cathlab system consisting of an X-ray system, etc.
Level 1	Raw Material		Surgical stainless steel, etc.

Source: Adapted from De Waal & Buys (2007)

Figure 4. Systems Hierarchy for Healthcare

Building

Healthcare Technology and Support Facilities and Equipment	**Level 5**	Products System	Pseudo Capability	Hospital Building System, Medical Equipment System, Clinical Engineering Workshops, Hospital Engineering Facilities, Training Materials and Facilities, etc.
	Level 2-4	Products		Medical Gas sub-system consisting out of a compressor, Cathlab system consisting of an X-ray system, etc.
	Level 1	Raw Material		Surgical stainless steel, etc.

Source: Adapted from De Waal & Buys (2007)

Figure 4. Systems Hierarchy for Healthcare

Service

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Physical Systems	M Deli	**Level 6**	Core System	Core Capability	In-patient Service Delivery, training of personnel
	Healthcare Technology and Support Facilities and Equipment	**Level 5**	Products System	Pseudo Capability	Hospital Building System, Medical Equipment System, Clinical Engineering Workshops, Hospital Engineering Facilities, Training Materials and Facilities, etc.
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Figure 4. Systems Hierarchy for Healthcare

Hospital Delivering Services

Physical Systems	M Deli	**Level 7**	Operational System	Operational Capability	Multi-disciplinary hospital
		Level 6	Core System	Core Capability	In-patient Service Delivery, training of personnel
	Healthcare Technology and Support Facilities and Equipment	**Level 5**	Products System	Pseudo Capability	Hospital Building System, Medical Equipment System, Clinical Engineering Workshops, Hospital Engineering Facilities, Training Materials and Facilities, etc.
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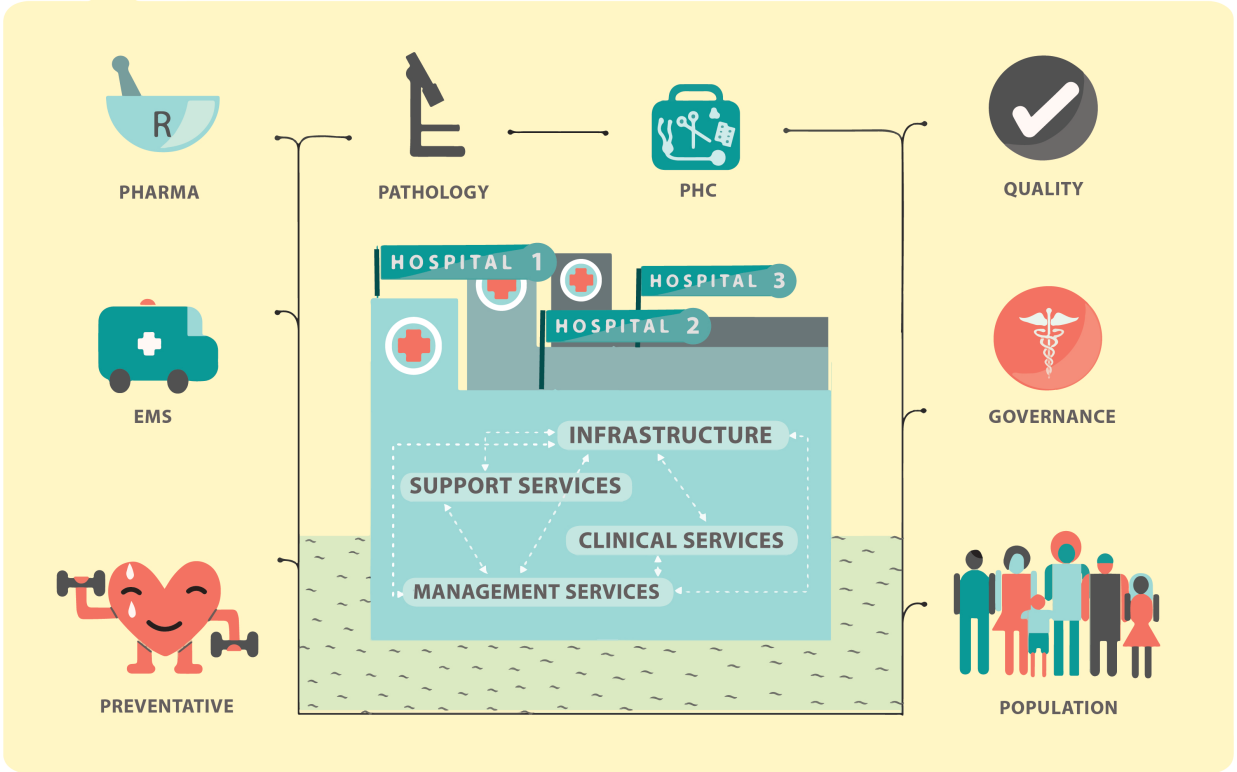
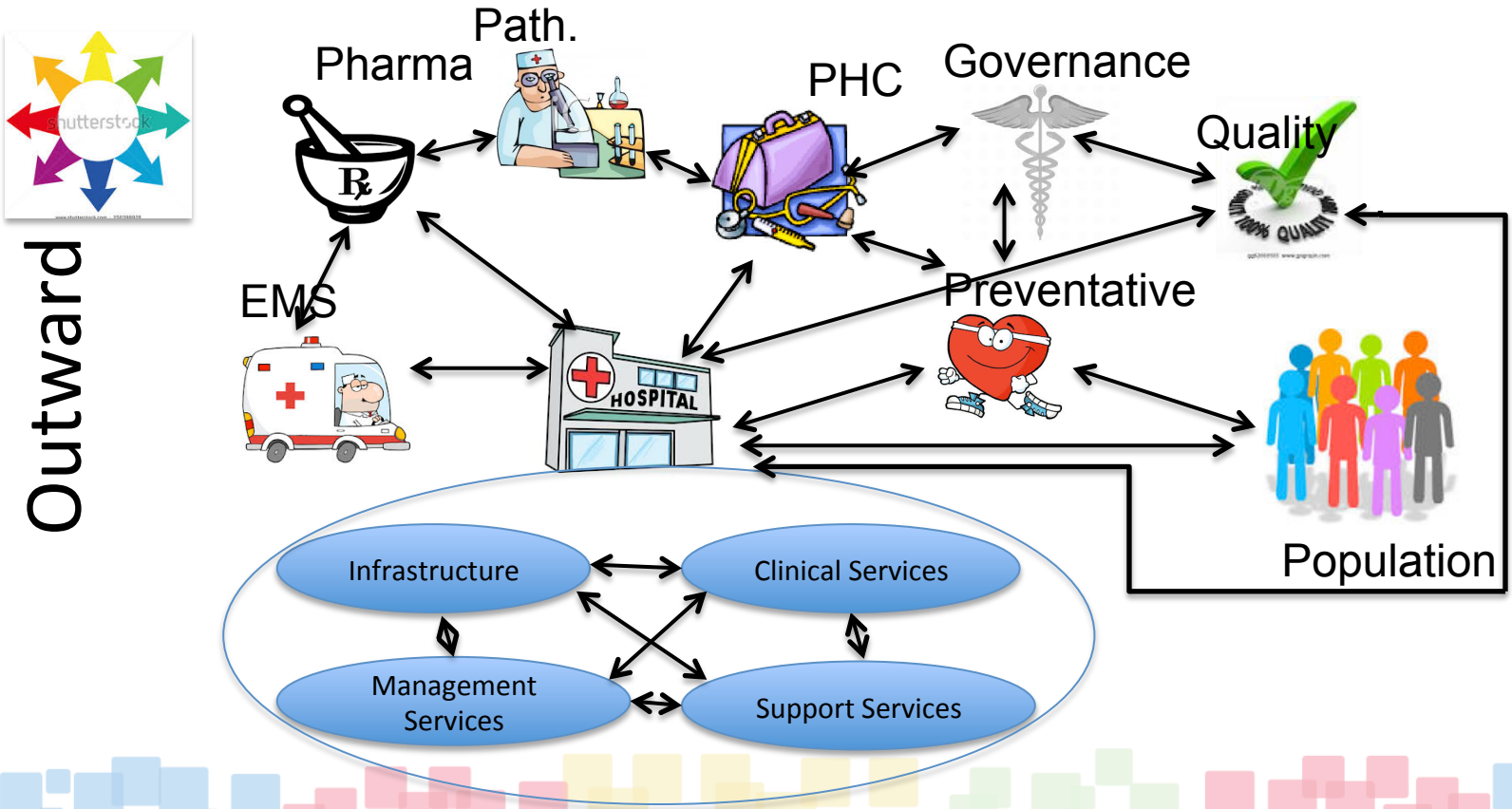
Healthcare System



A Hospital within the Healthcare System



Physical Systems	Medical Service Delivery Backstage and Support	**Level 8**	Joint Higher Order Organisational Systems	Coordinated Operational Capability	National Healthcare System
		Level 7	Operational System	Operational Capability	Multi-disciplinary hospital
		Level 6	Core System	Core Capability	In-patient Service Delivery, training of personnel
	Healthcare Technology and Support Facilities and Equipment	**Level 5**	Products System	Pseudo Capability	Hospital Building System, Medical Equipment System, Clinical Engineering Workshops, Hospital Engineering Facilities, Training Materials and Facilities, etc.
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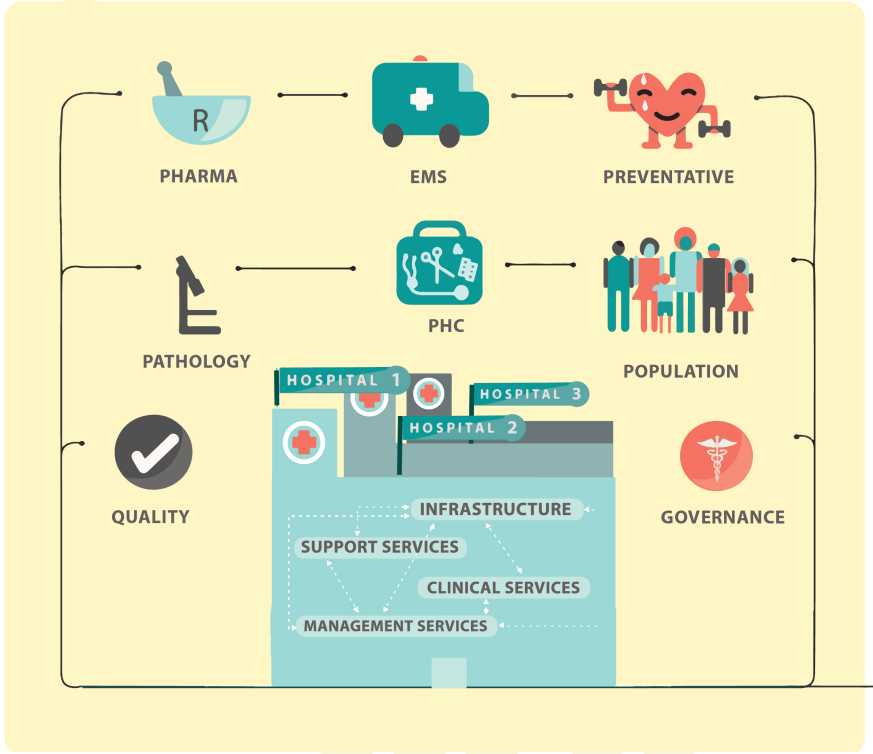
Figure 4. Systems Hierarchy for Healthcare

Healtcare Environment Systems



- ADMINISTRATIVE SYSTEM
- POLITICAL SYSTEM
- FINANCIAL SYSTEM
- LEGAL SYSTEM
- EDUCATIONAL SYSTEM

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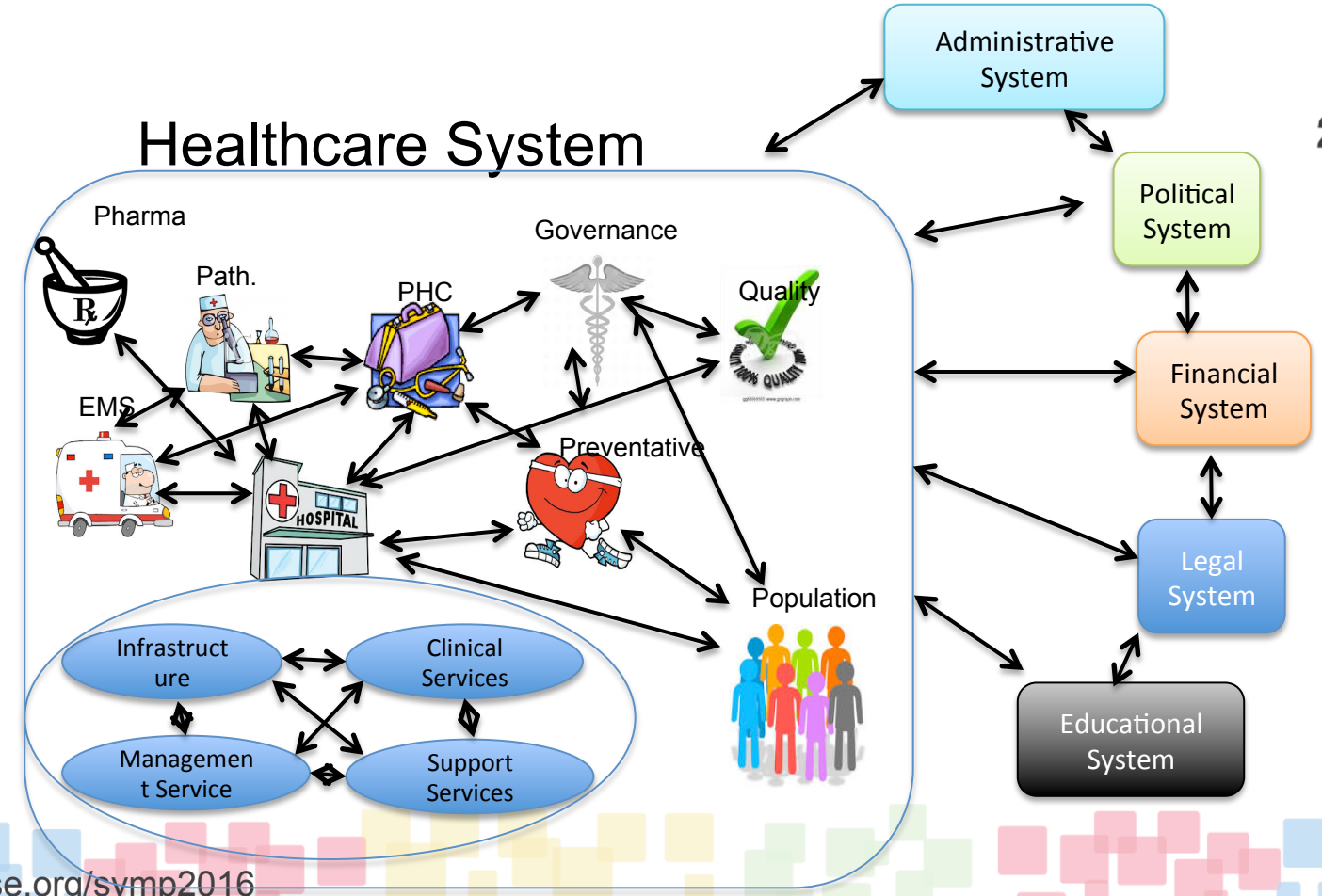
Healthcare System
Pharma
Path.
PHC
Governance
Quality
EMS
Preventative
HOSPITAL
Population
Infrastructure
Clinical Services
Management Service
Support Services
Administrative System
Political System
Financial System
Legal System
Educational System

Type	Level Summary	Systems Hierarchy Level	Description	Type of Capability	Example
Virtual Systems	National and International Levels	**Level 9-10**	Multi-government and societal systems	Regulated Operational Capability	World Health Organisation (WHO), interministerial committee on health, etc.
	Medical Service Delivery Backstage and Support	**Level 8**	Joint Higher Order Organisational Systems	Coordinated Operational Capability	National Healthcare System
		Level 7	Operational System	Operational Capability	Multi-disciplinary hospital
Physical Systems		**Level 6**	Core System	Core Capability	In-patient Service Delivery, training of personnel
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Figure 4. Systems Hierarchy for Healthcare

Lifecycle for Large Infrastructure Projects

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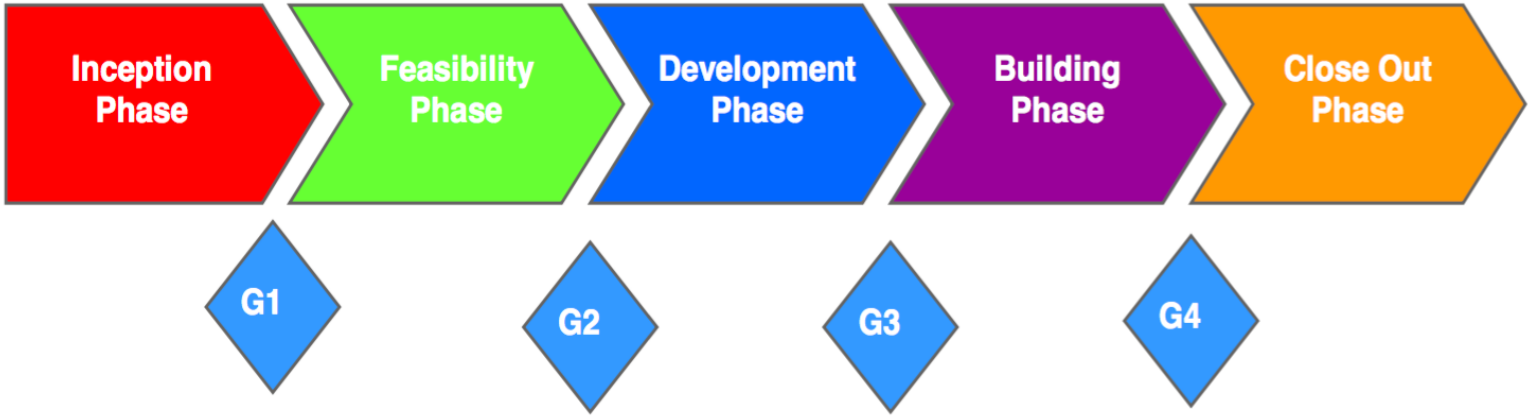
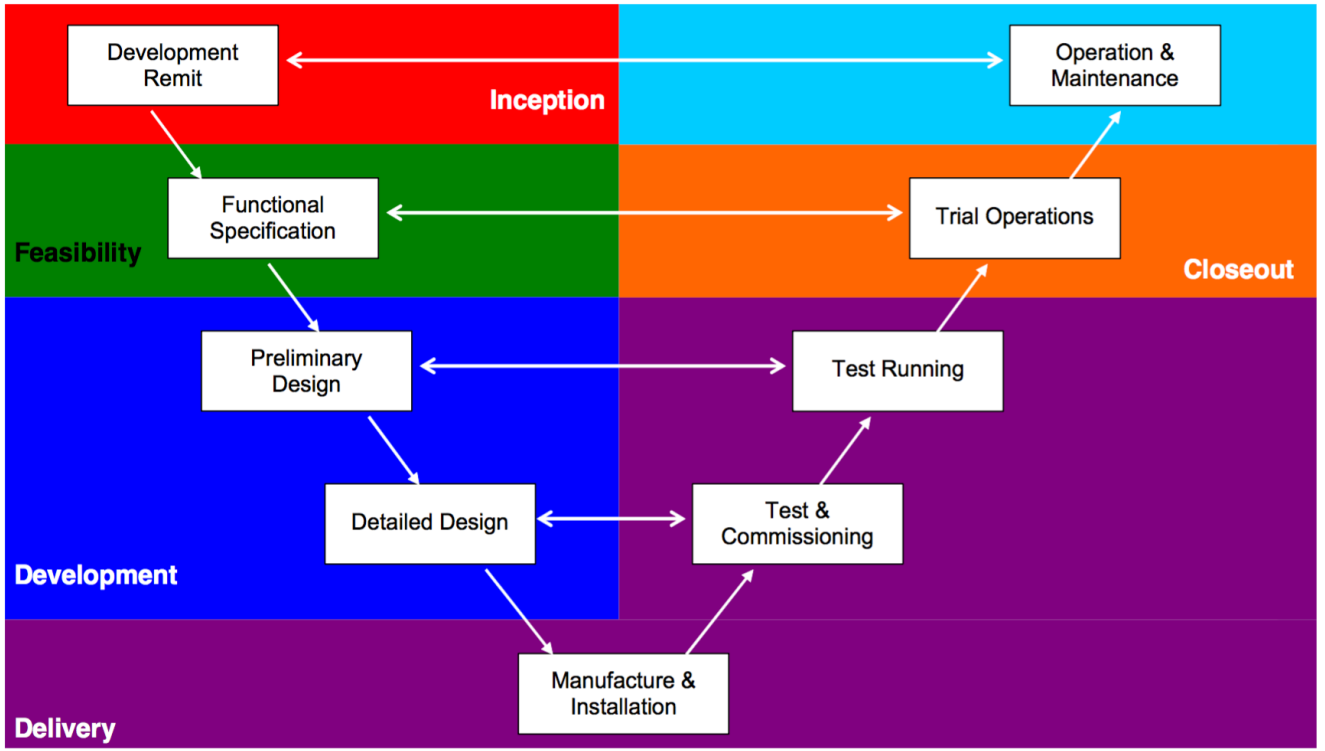


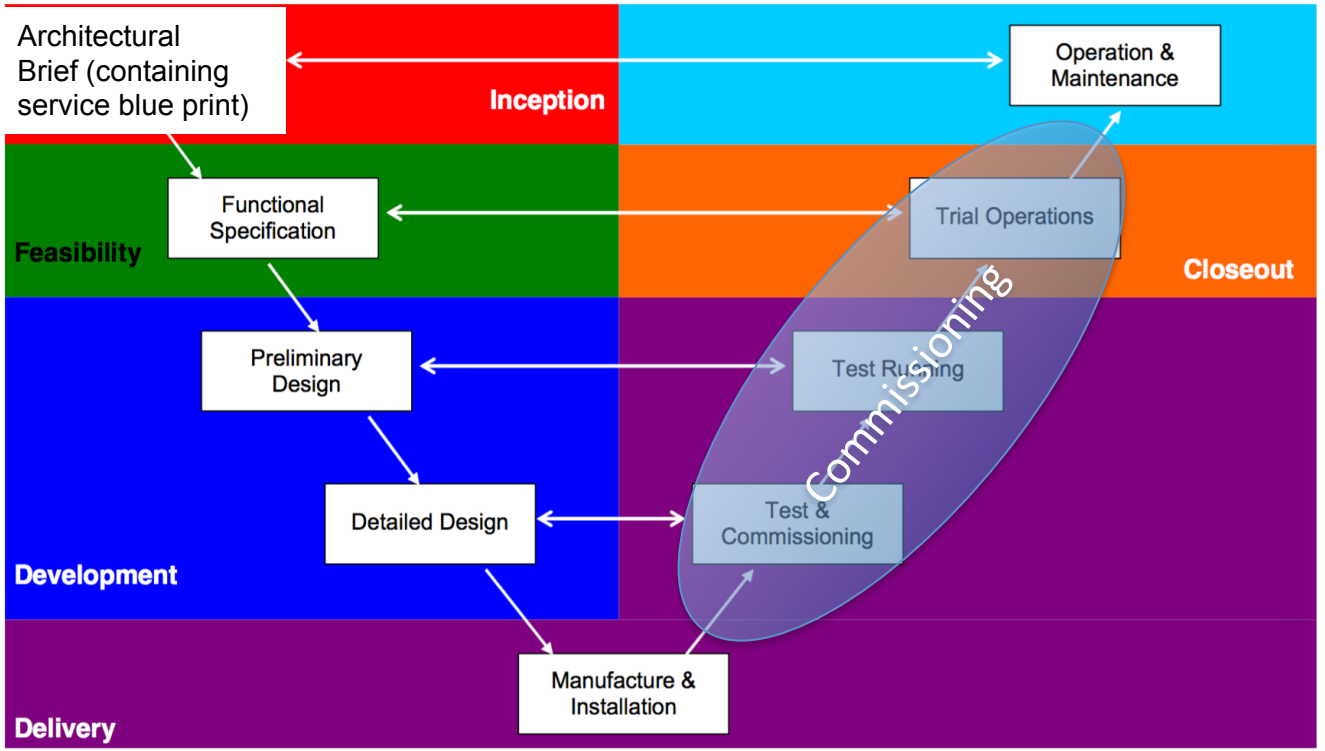
Source: INCOSE – IWG NETLIPSE

Hospital System of Systems

- Lifecycle for Large Infrastructure Projects → systems in the SofS are separated in space and time.
- Hospital → two dimensions are less of a problem but some systems behaves as SoS → virtually separated in other dimensions



Source: INCOSE – IWG NETLIPSE



Source: INCOSE – IWG NETLIPSE

Lifecycle for Large Infrastructure Projects

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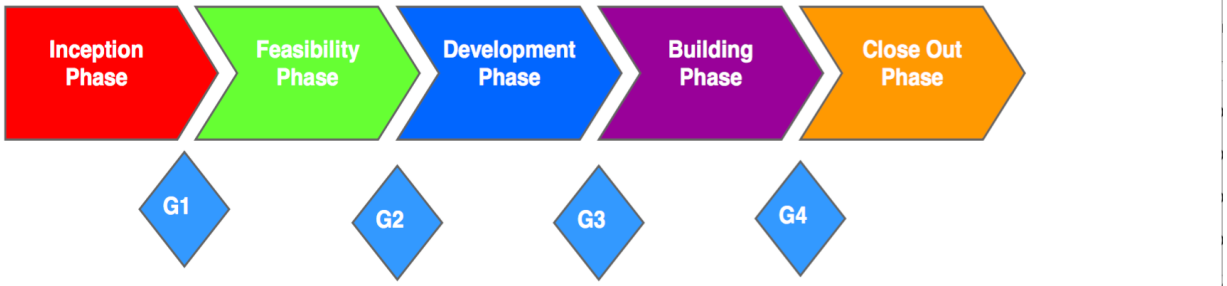

Source: INCOSE – IWG NETLIPSE

- Only Development, Manufacturing, Construction, Installation & Implementation, and Commissioning phases are treated.
- Operations & Support and Decommissioning phases are not shown.
-

Source: INCOSE – SE Handbook V3

Considering all life cycle phases during design

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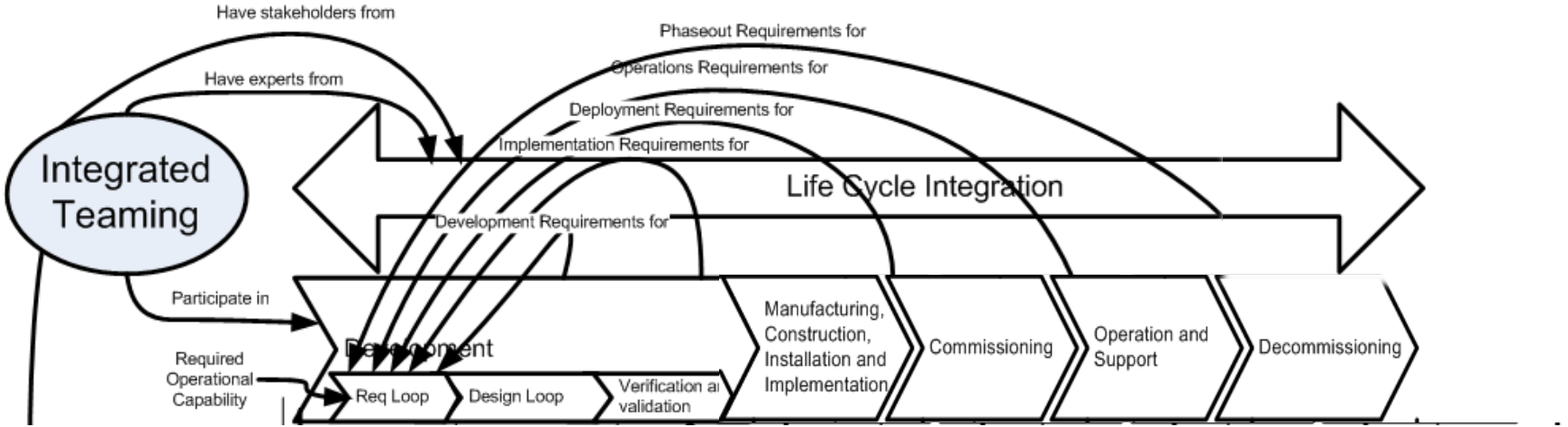

For sustainable design, all the lifecycle phases should be

Inward Commissioning

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- Intangible and tangible elements of Level 5 to 7 systems are analyzed, audited, inspected, demonstrated or tested in the context of the applicable systems level before they are transitioned for utilization in the next higher level.

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- Test Running during the Delivery phase of the project is done on Healthcare Capabilities with Core Systems (Level 6 Systems).

- Test & Commissioning is done on the Product Systems (Level 5 Systems) to transition them for use in Core Systems (Level 6 Systems).

Inward Commissioning

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- **Tangibles, e.g.**
  - Building,
  - equipment and
  - Medication
  - Etc.
- Constituting the Level 5 Product Systems.

Inward Commissioning

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- **Intangibles, e.g.**
  - Management,
  - Policies and
  - Skills of employees
  - Etc.
- Constitute part of Level 5 Product Systems and the Core Systems for the Level 6 Healthcare Capability

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- The servicescape encountered on Level 7 Operational Hospital also consists of intangibles.

Outward Commissioning

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- Uses the Level 7 System (Operational Hospital) within the larger National Healtcare System (Level 8 System) and Level 9 System.
- Trial Operations during the Closeout phase of the project is when this should be finalised.

Outward Commissioning

- **Inside the Health System**
  - Range of interfaces between the new hospital and the components of the Health System need to be established.

Outward Commissioning

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- **Inside the Health System**
  - Emergency Medical Services (EMS) → operate within the geographic area, protocols for of patients need to be established.
  - Undesirable to communicate with the new facility regarding their ability to accept and treat an emergency while they are already transporting the patient

Outward Commissioning

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- **Inside the Health System**
  - Capability of the facility to accept emergencies must be clearly agreed upfront.
  - In terms of in-patient referral, similar protocols need to be establish.
  - No facility is ably to treat every kind of conditions.

Outward Commissioning

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- **Inside the Health System**
  - New facility needs to discuss with the facility's delivering service both at a lower and a higher level of care compared to them, the terms on which intra-facility transfers will take place.
  - This interface is much more complex than that which relate to EMS as the facilities to which and from which they might transfer might be geographically quite distant.

Outward Commissioning

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- **Inside the Health System**
  - For example radiation oncology to treat certain cancers are deliver in highly specialised facilities which are only found in major centres. If such a service is needed, a patient might be transferred to a facility hundreds of kilometres away.
  - These interfaces needs to be established upfront.

Outward Commissioning

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- **Outside the Health System.** Interfaces between other systems also need to be established.
  - E.g. financial system needs to be engaged in order for transaction to be able to take place.
  - Open bank accounts in order to trade.
  - Establish a legal entity to enter into contracts, or pay taxes.

Outward Commissioning

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- **Outside the Health System.** Interfaces between other systems also need to be established.
  - Establish voice and data services in order for both business and clinical service communication to take place.

Bringing the Project Management, Systems Engineering and Commissioning Together

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- Systems Engineering in Large Infrastructure Projects (LIP) (INCOSE IWG NETLIPSE, 2012).
- Involve the design and construction of new railway or power generation and distribution capacity.
- Planning, design and construction can span years and even decades.

Bringing the Project Management, Systems Engineering and Commissioning Together

- Hospital development → not usually qualify as a LIP → construction in one location and not multiple sites with vastly diverse project timeline.
- Complexity of interfacing many new systems as well as interfacing with existing systems
- Common elements of large scale construction, many of the special conditions defined in LIP apply.

Bringing the Project Management, Systems Engineering and Commissioning Together

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- Common element of large scale construction include:
  - complex building services coordination,
  - significant amount of statutory compliance needed in order to obtain certification to occupy the building,
  - long and complicated construction project planning and execution.

Bringing the Project Management, Systems Engineering and Commissioning Together

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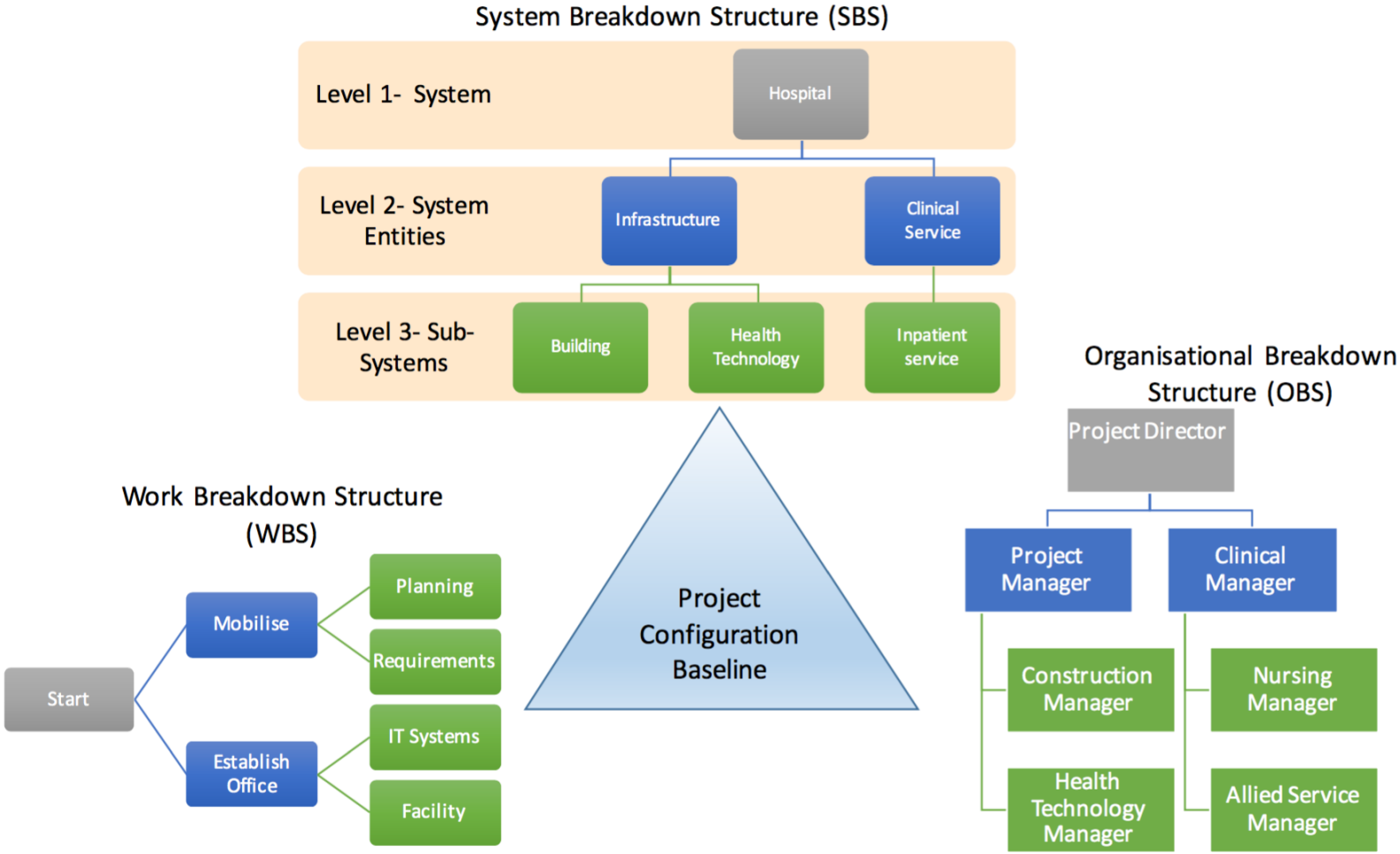
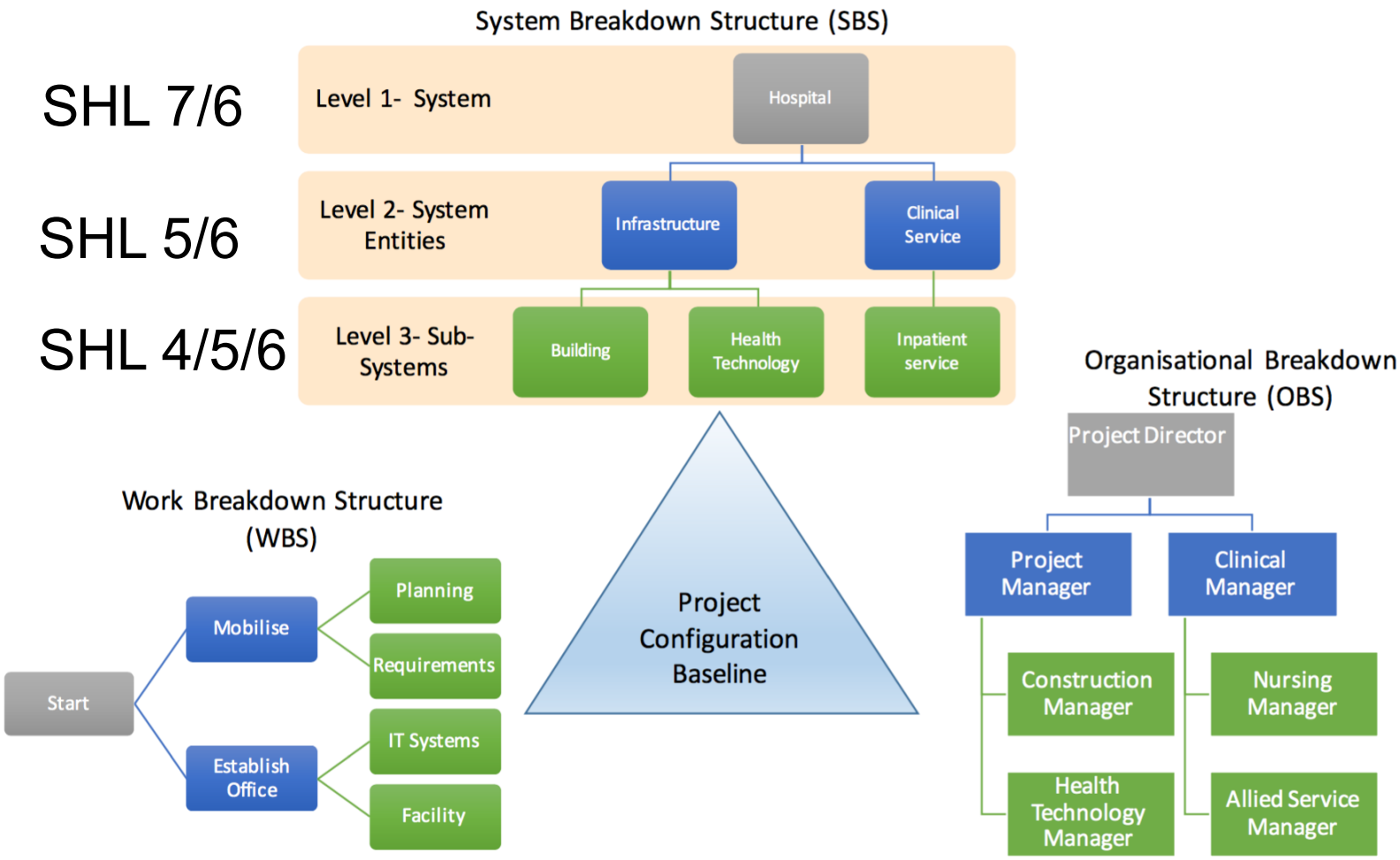
- A LIP condition → focus on the relationship between System-, Work- and Organisational Breakdown Structure captured in the Project Configuration Baseline.

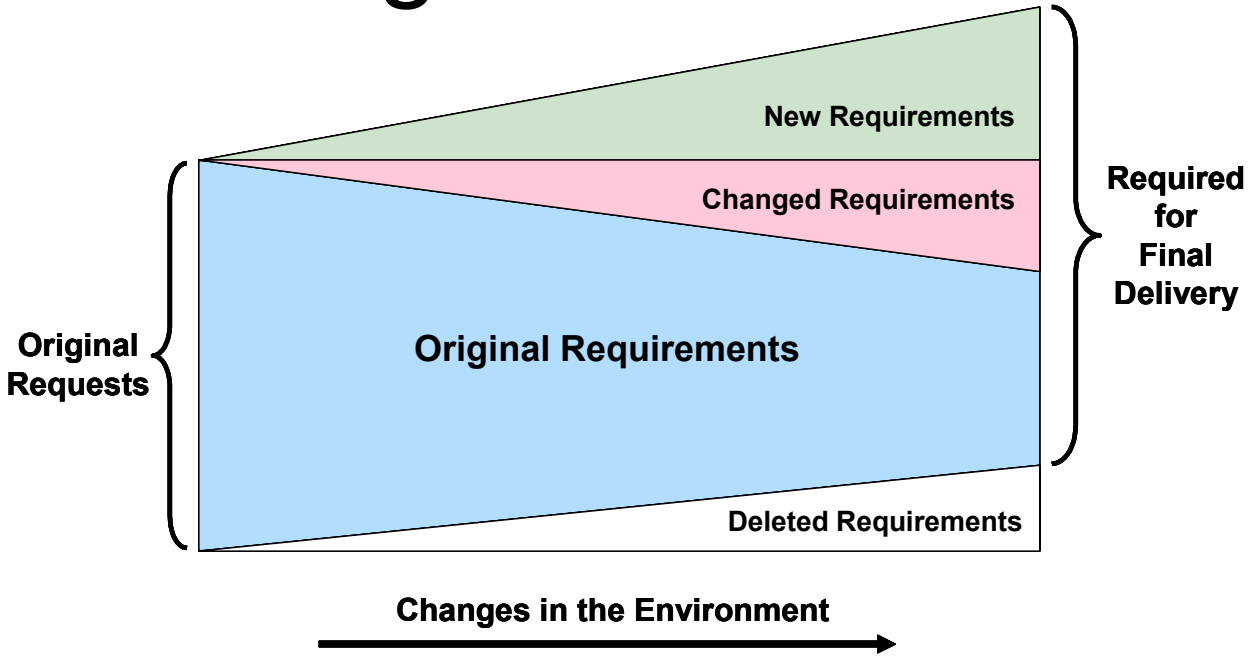


Source: INCOSE – IWG NETLIPSE(adapted)



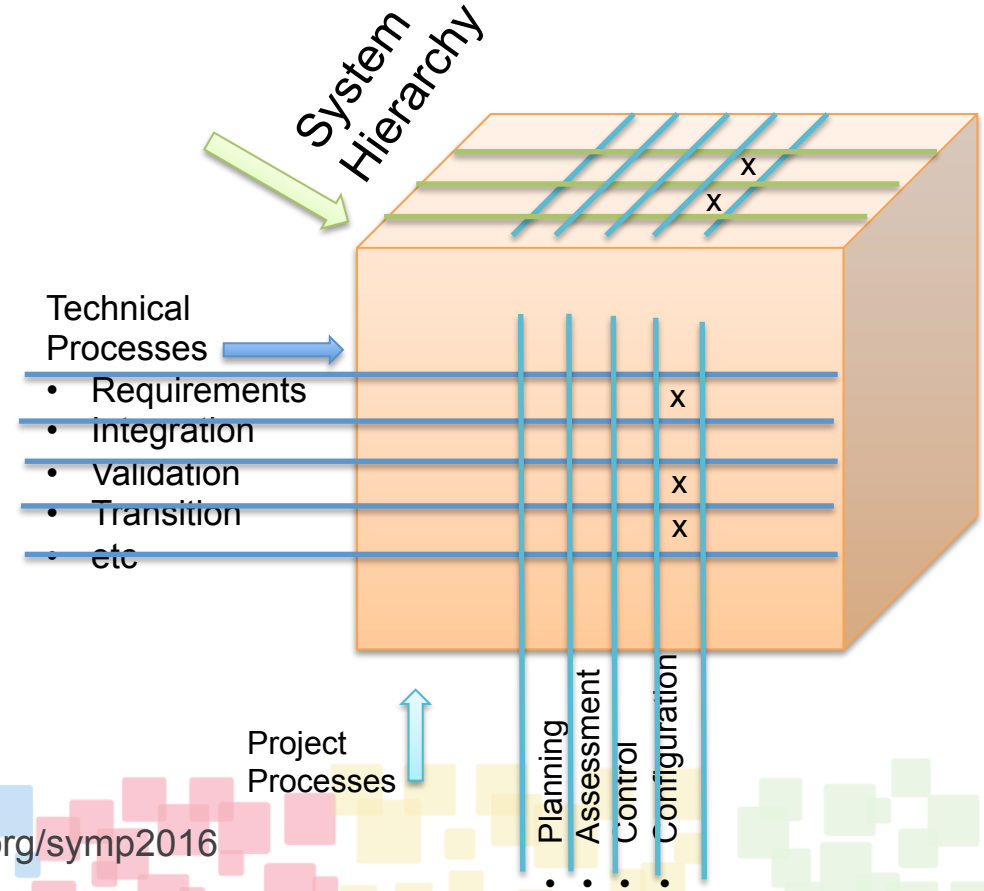
Source: INCOSE – IWG NETLIPSE(adapted)

What is Configuration Management?

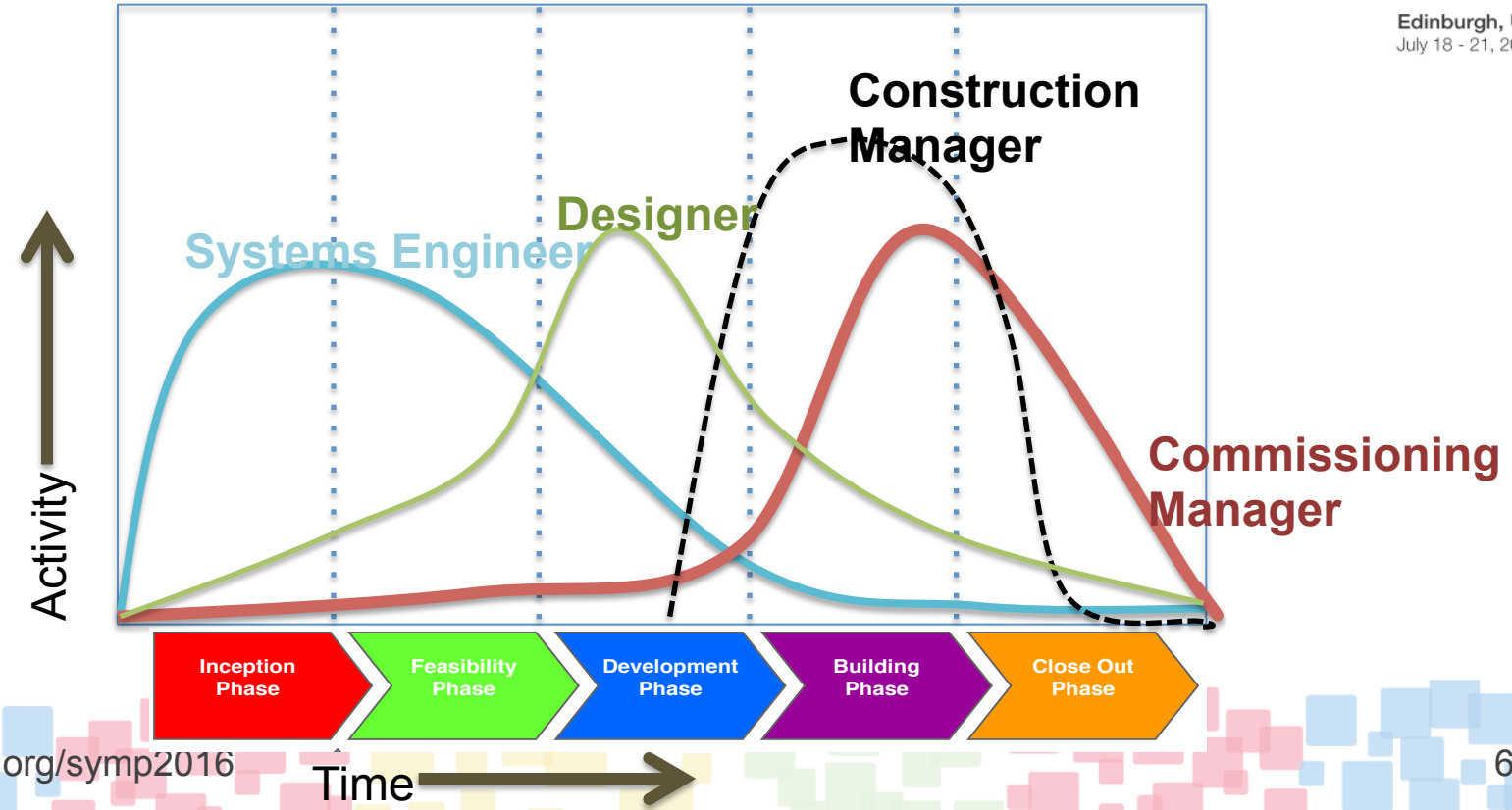


Source: INCOSE – SE Handbook V3

SE Concept Relationships



Activity of Various Role Players throughout the Project Life Cycle



Why consider SE in Healthcare Infrastructure Development?

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- Complexity of the projects
- Long project timelines
- SE offers established and useful methodologies
- SE comes with a complete separate pool of expertise that can feed into Healthcare Infrastructure Development Projects

In conclusion

The challenges we face in commissioning of Health Facilities are significant, both in volume and in magnitude, but *they are not unique*.

Systems Engineering offers a number of tools which could improve our approach to commissioning and our ability to deliver successful, quality facilities.

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