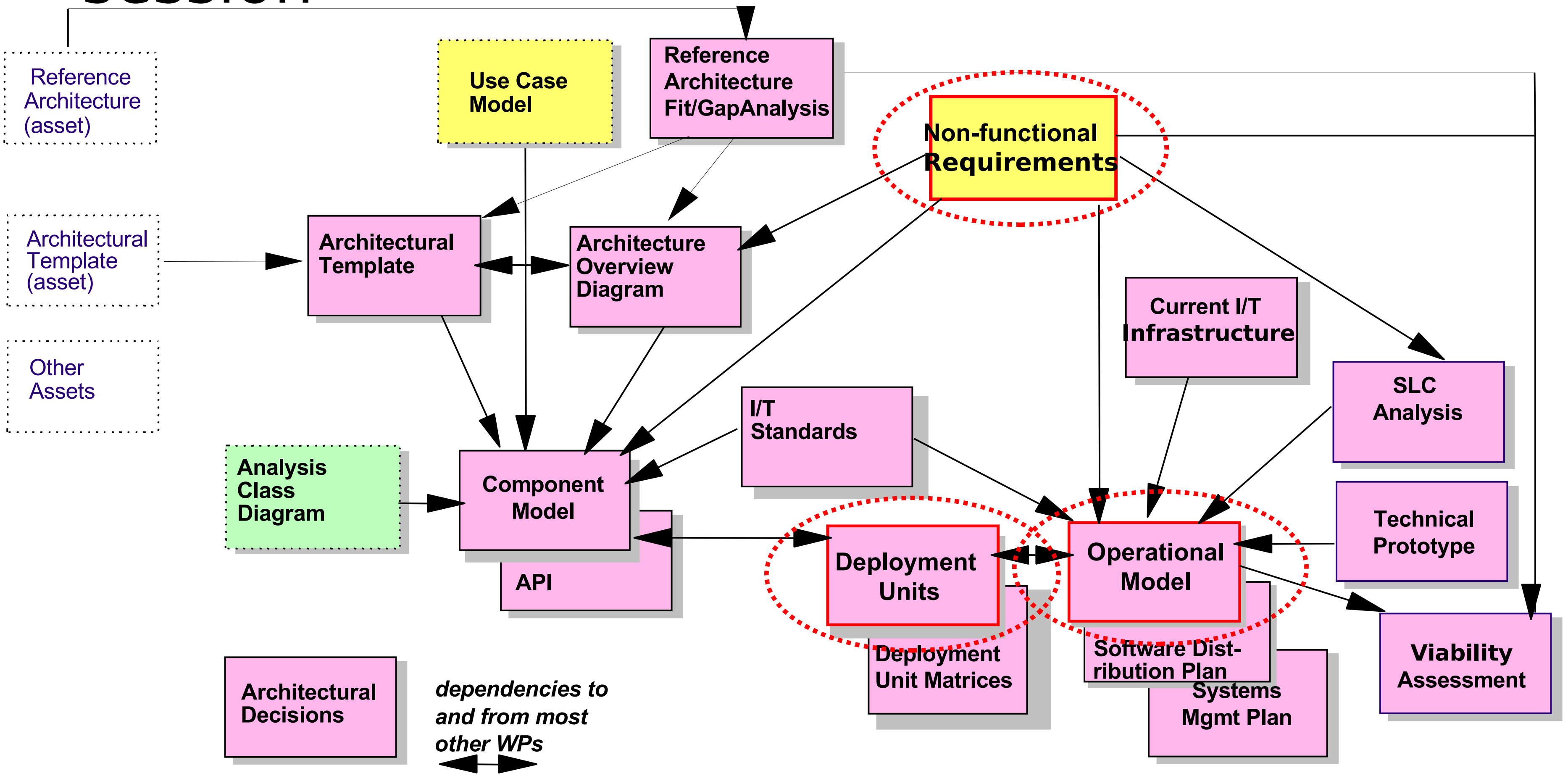
Key Work Products Part 3

Non-Functional Requirements, Operational Model, and Technical Walkthroughs

Agenda

- 1. Non-Functional Requirements
- 2. Operational Model
  - the “infrastructure” design
  - Deployment Units
  - Technical Walkthroughs

Context of Work Products covered in this session

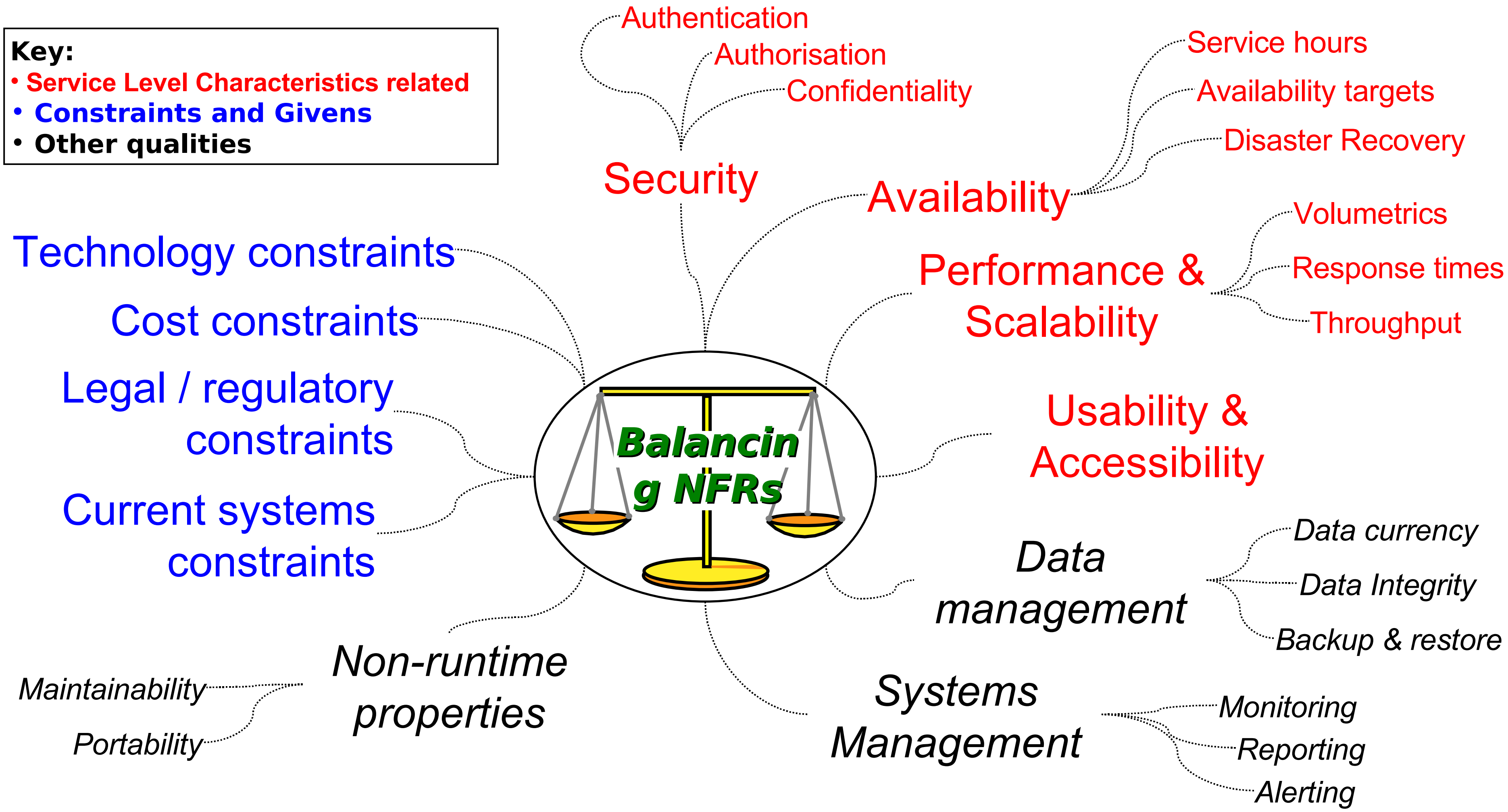


1. Non-Functional Requirements (NFRs)

- Purpose of the Non-Functional requirements WP:
  - To capture all desired runtime properties – plus any other desired properties – of the target IT system
    - These are separate from the functionality requirements (see Use Cases etc.), but will often relate to them
  - To document all constraints and givens which need to be taken into account in the design of the system
- NFRs influence both the application and infrastructure design
  - Overall system qualities are a function of both software and hardware behaviour
  - E.g. good performance requires efficient application design plus provisioning of sufficient server and network capacity

Typical Categories of Non-functional Requirements

Key:
- **Service Level Characteristics related**
- **Constraints and Givens**
- **Other qualities**



Balancin
g NFRs

Security
- Authentication
- Authorisation
- Confidentiality

Availability
- Service hours
- Availability targets
- Disaster Recovery

Performance & Scalability
- Volumetrics
- Response times
- Throughput

Usability & Accessibility

Data management
- *Data currency*
- *Data Integrity*
- *Backup & restore*

Systems Management
- *Monitoring*
- *Reporting*
- *Alerting*

Non-runtime properties
- *Maintainability*
- *Portability*

Technology constraints

Cost constraints

Legal / regulatory constraints

Current systems constraints

Good vs. Bad NFRs

- Well specified NFRs are:
  - Correct
  - Unambiguous
  - Complete
  - Consistent
  - Measurable (verifiable)
  - Traceable
  - Actionable
  - Design independent
- Note on feasibility:
  - It may not be possible to meet a particular NFR given other constraints – if so, this is a design/business issue

- NFRs are *not* well specified if they are:
  - Misrepresentative of the true business need
  - Open to interpretation
  - High-level “principles” or “guidelines”
  - Conflicting
  - Not possible to test
  - Implying a specific solution or technology

  - Missing !

2. Operational Model (OM)

- The Operational Model can be thought of as the “infrastructure architecture”, documenting the design for:
  - The overall geographic structure of the locations and zones over which the IT system will operate
  - The logical and physical nodes which represent the computers, network components and other devices which comprise the system’s infrastructure
  - The placement of both application and technical components across the system’s locations and nodes
  - The connections between nodes which are required to support the interactions of the components
- At the lowest level (Physical level), the OM ultimately documents:
  - The overall configuration of the technologies and products necessary to deliver the functional and non-functional requirements of the IT system
  - The hardware and software technologies and products which have been selected
  - Sizings and hardware specifications for all the computers, storage devices and networks
- One of the primary concerns of the Operational Model is to ensure the solution meets all the Non-functional Requirements!

Levels of abstraction of the Operational Model

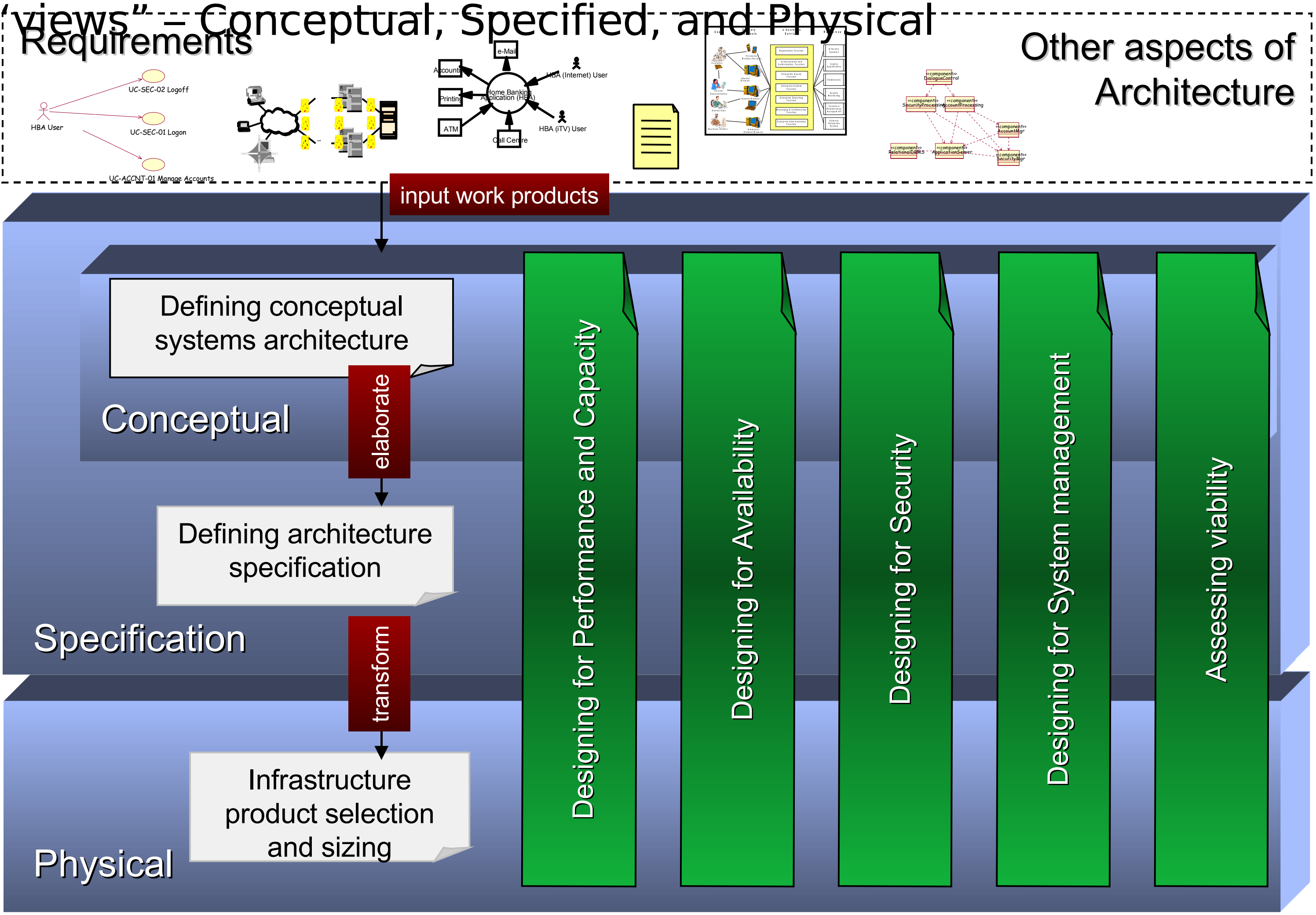
The three “views” – Conceptual, Specified, and Physical

Requirements, constraints and other factors

Technology neutral, distributed structure of the business solution

Technical services & specifications required to make this solution work

Products and platforms chosen to deliver the functionality and service levels


HBA User
UC-SEC-02 Logoff
UC-SEC-01 Logon
UC-ACCNT-01 Manage Accounts
e-Mail
Accounts
Printing
ATM
Home Banking Application (HBA)
HBA (Internet) User
HBA (iTV) User
Call Centre
«component» DialogueControl
«component» SecurityProcessing
«component» AccountProcessing
«component» AccountMgr
«component» RelationalDBMS
«component» ApplicationServer
«component» SecurityMgr

Requirements

Other aspects of Architecture

input work products

Defining conceptual systems architecture

Conceptual

elaborate

Defining architecture specification

Specification

transform

Infrastructure product selection and sizing

Physical

Designing for Performance and Capacity

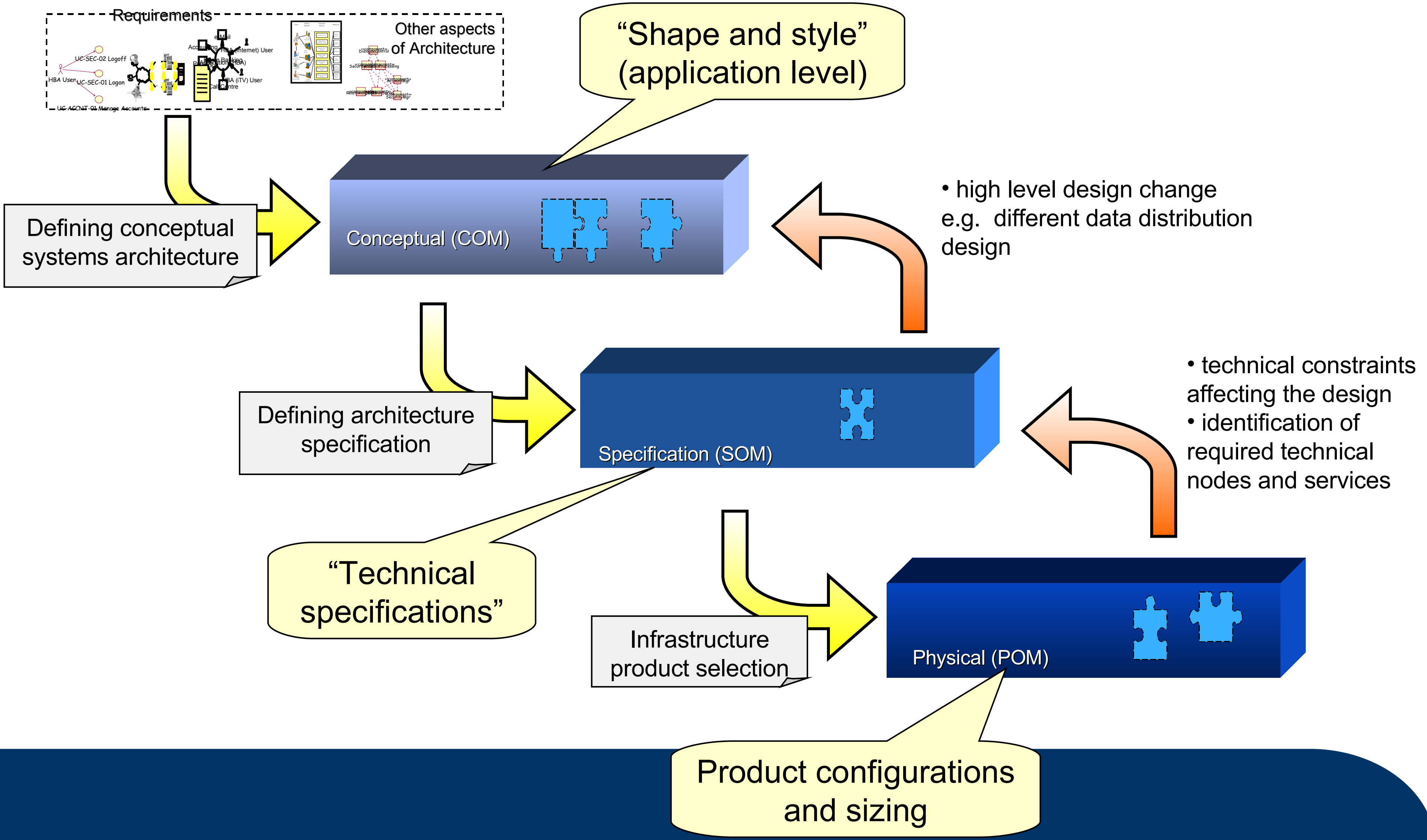
Designing for Availability

Designing for Security

Designing for System management

Assessing viability

The different levels (or ‘views’) of the Operational Model influence each other – in both directions



Requirements

Other aspects of Architecture

“Shape and style” (application level)

Defining conceptual systems architecture

Conceptual (COM)

- high level design change e.g. different data distribution design

Defining architecture specification

Specification (SOM)

- technical constraints affecting the design
- identification of required technical nodes and services

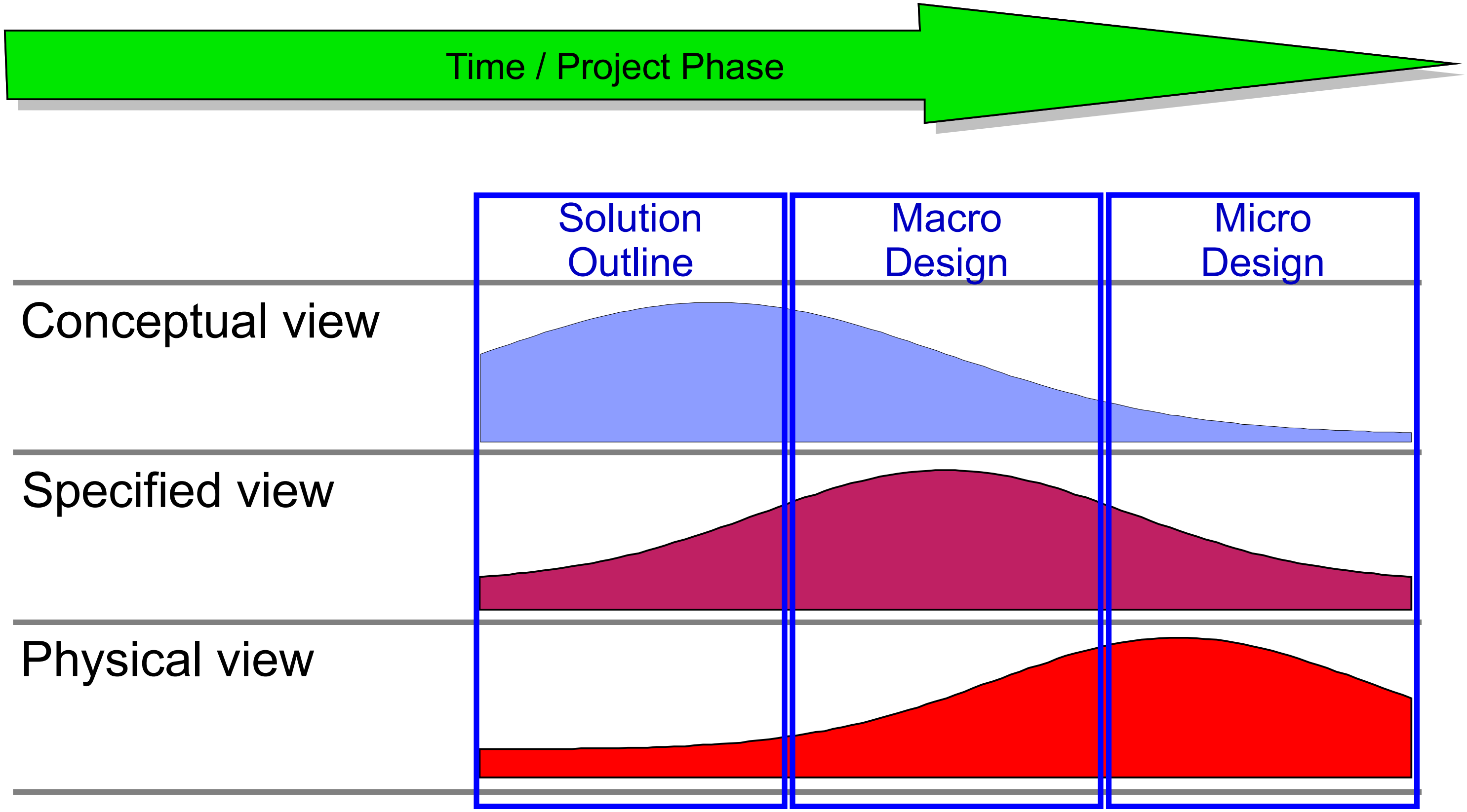
“Technical specifications”

Infrastructure product selection

Physical (POM)

Product configurations and sizing

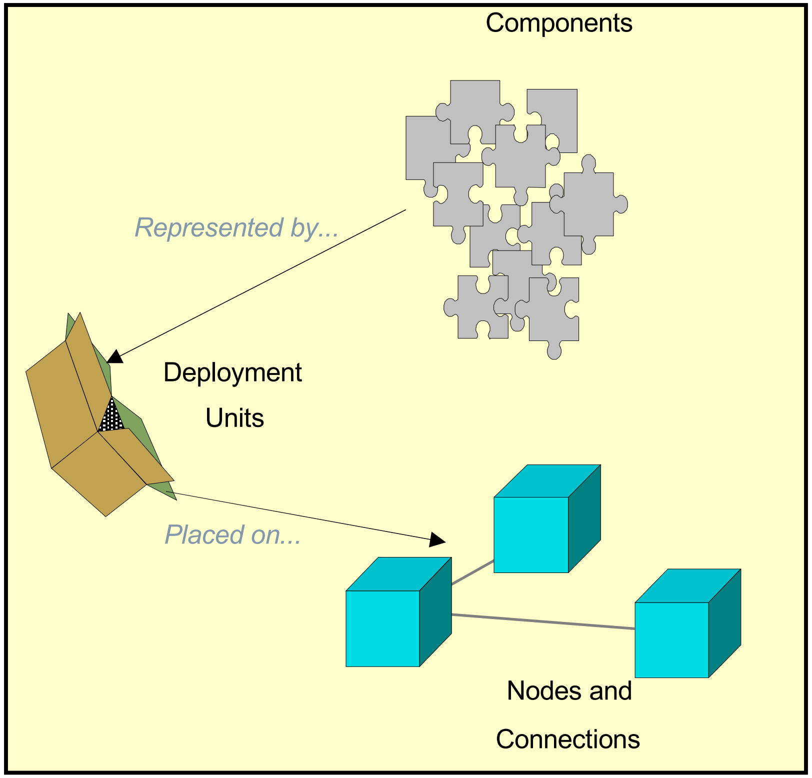
The effort expended on developing the views changes from 'more logical' to 'more physical‘ over the lifetime of the project



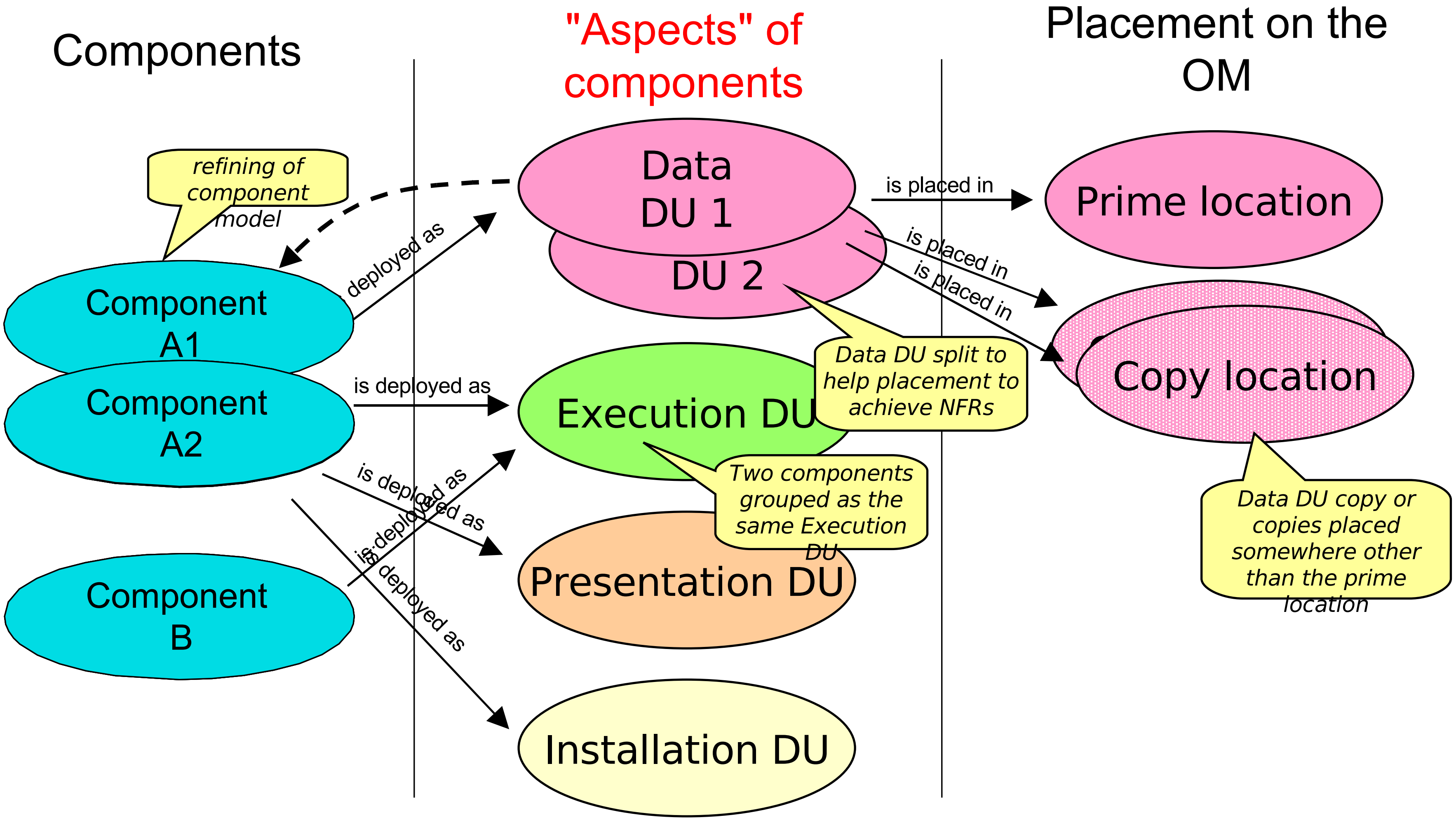
Operational Modelling is underpinned by a formal modelling language and notation – these provide an unambiguous means of representing your designs

Some key elements:

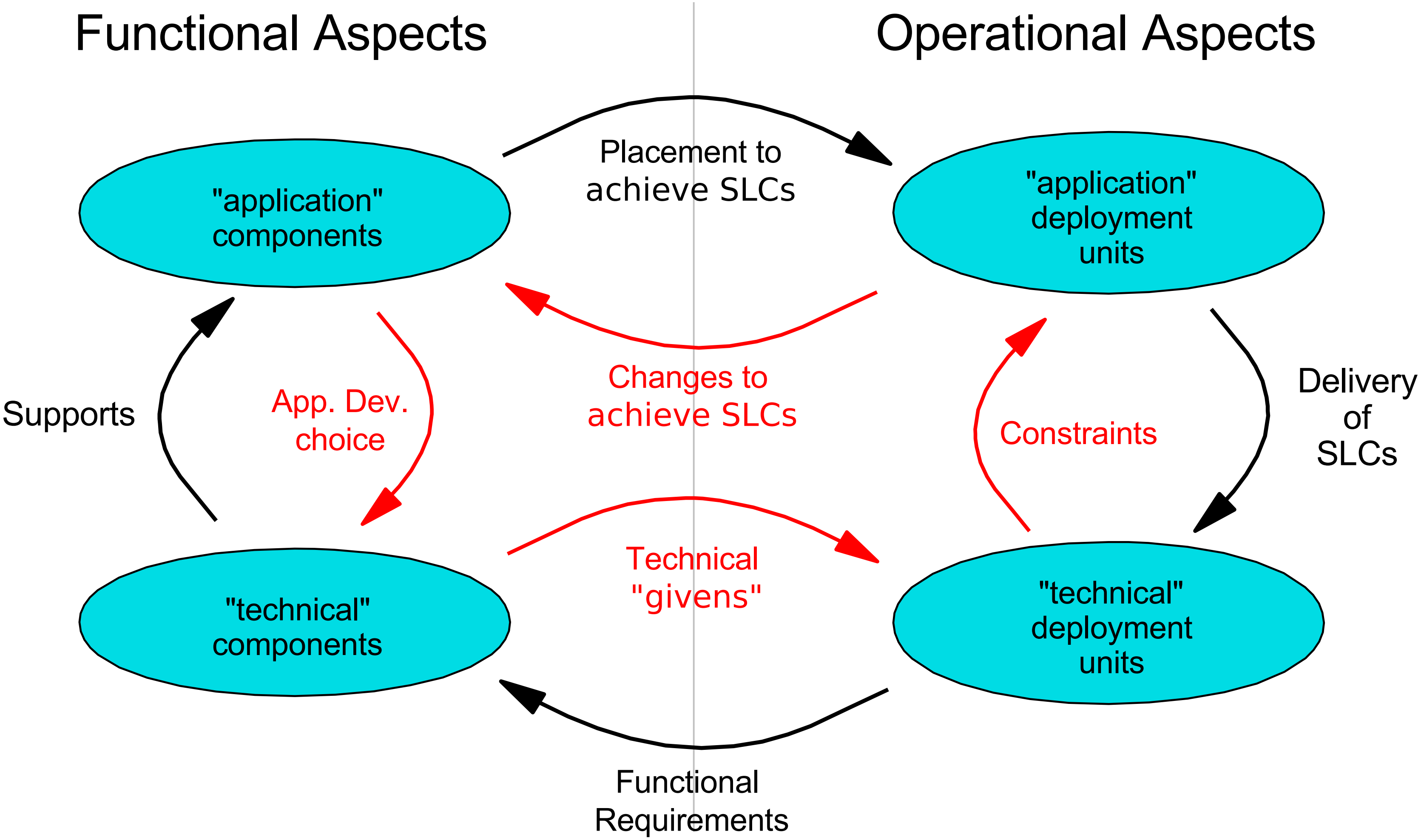
- A *node* is an envisaged execution environment on which the various aspects (e.g. execution, data) of software *components* can be installed
- *Deployment units* (DUs) represent the various aspects of *components* which can be placed onto nodes.
- *Connections* represent links between nodes, upon which *component interactions* are supported



The placement of components onto the Operational Model via Deployment Units can be complicated ...



The Operational Model can drive the definition of technical components through technical DUs...and vice versa



How is the Operational Model represented?

Examples of Formal Notation

KEY:

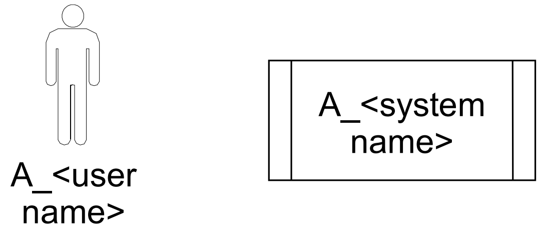
═════	No linkage available
─────	Low capability linkage
··········	Medium capability linkage
- - - - -	High capability linkage

Location Borders

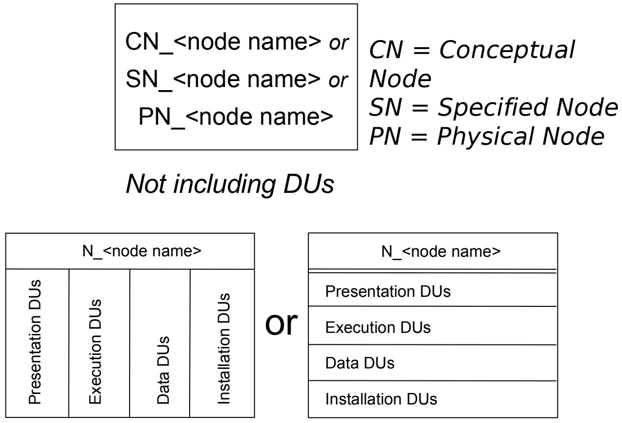
KEY:

Z_Extranet:	nominated external parties
Z_Internet Env't:	Public
Z_DMZ:	Firewall protected
Z_corporate domain	internal employees / trusted zone

Zone Characteristics



Actors and External Systems

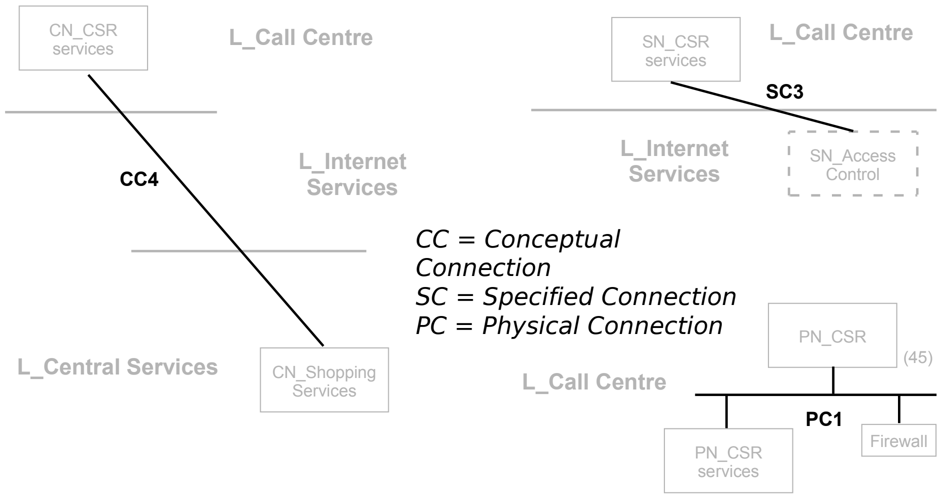


CN = Conceptual Node
SN = Specified Node
PN = Physical Node

Not including DUs

Including DUs

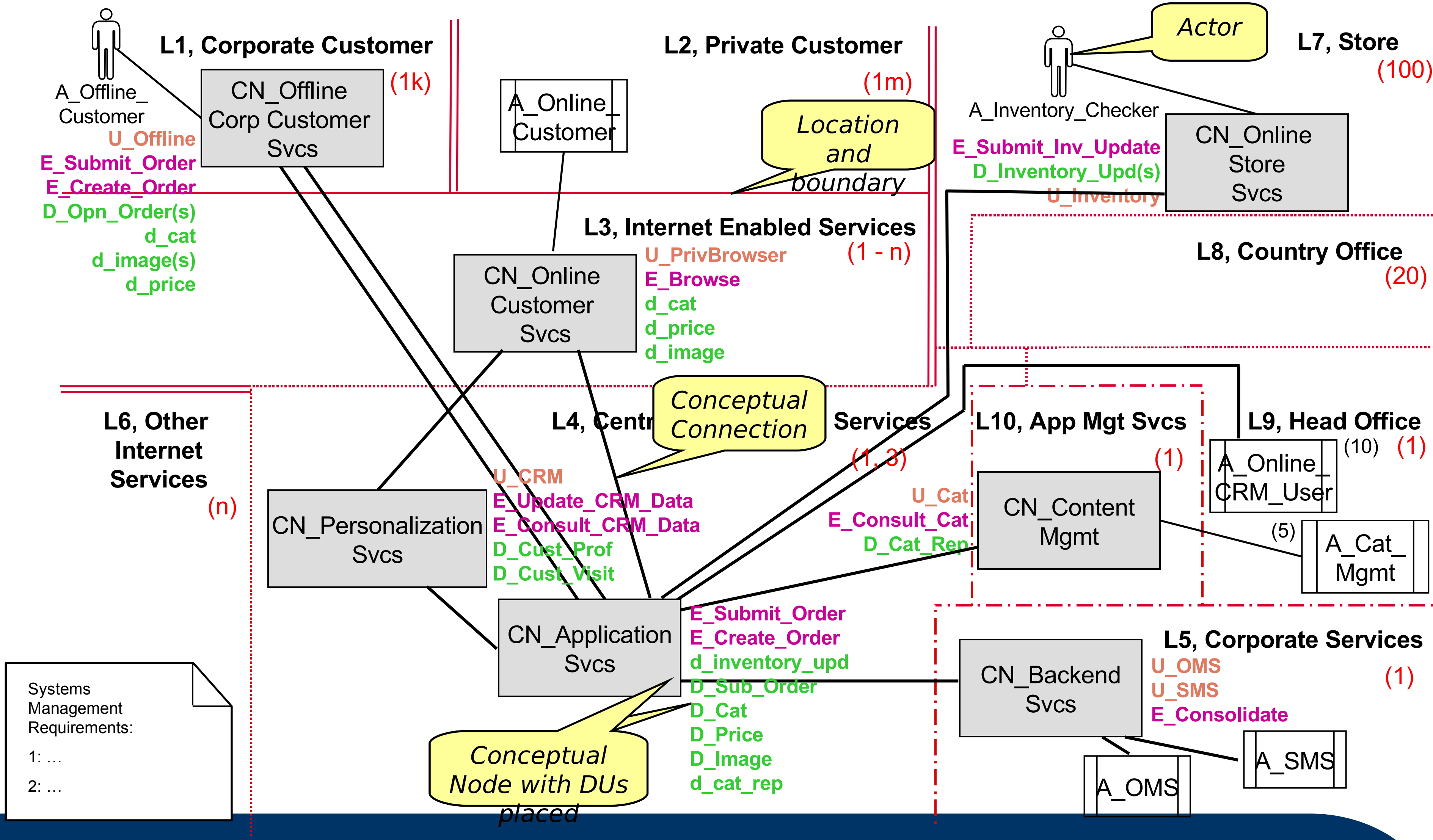
Nodes and placed DUs



CC = Conceptual Connection
SC = Specified Connection
PC = Physical Connection

Connections: conceptual (left), specified (top right), physical (bottom right)

Sample Conceptual Operational Model



L1, Corporate Customer (1k)

A_Offline_ Customer

U_Offline
E_Submit_Order
E_Create_Order
D_Opn_Order(s)
d_cat
d_image(s)
d_price

CN_Offline Corp Customer Svcs

L2, Private Customer (1m)

A_Online_ Customer

Location and boundary

Actor

L7, Store (100)

A_Inventory_Checker

E_Submit_Inv_Update
D_Inventory_Upd(s)
U_Inventory

CN_Online Store Svcs

L3, Internet Enabled Services (1 - n)

CN_Online Customer Svcs

U_PrivBrowser
E_Browse
d_cat
d_price
d_image

L8, Country Office (20)

L6, Other Internet Services (n)

L4, Centr Conceptual Connection Services (1, 3)

CN_Personalization Svcs

U_CRM
E_Update_CRM_Data
E_Consult_CRM_Data
D_Cust_Prof
D_Cust_Visit

L10, App Mgt Svcs (1)

U_Cat
E_Consult_Cat
D_Cat_Rep

CN_Content Mgmt

L9, Head Office (1)

A_Online_ CRM_User (10)

(5) A_Cat_ Mgmt

CN_Application Svcs

E_Submit_Order
E_Create_Order
d_inventory_upd
D_Sub_Order
D_Cat
D_Price
D_Image
d_cat_rep

Conceptual Node with DUs placed

L5, Corporate Services (1)

CN_Backend Svcs

U_OMS
U_SMS
E_Consolidate

A_OMS

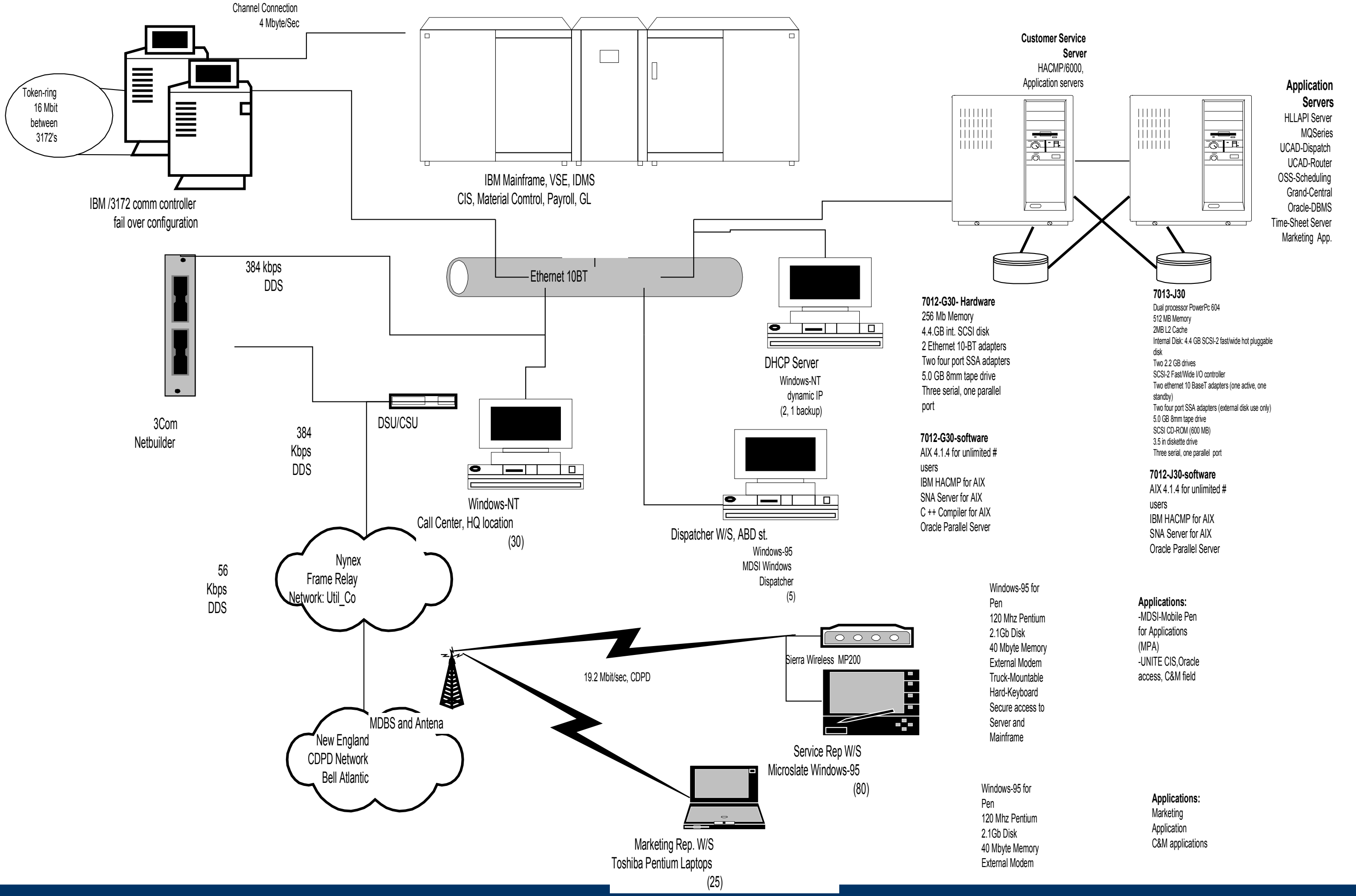
A_SMS

Systems Management Requirements:

1: …

2: …

At the Physical Level, the Operational Model represents the physical distribution of the IT system - sometimes pictorially ...



Channel Connection
4 Mbyte/Sec

Token-ring
16 Mbit
between
3172's

IBM /3172 comm controller
fail over configuration

IBM Mainframe, VSE, IDMS
CIS, Material Comtrol, Payroll, GL

Customer Service
Server
HACMP/6000,
Application servers

Application
Servers
HLLAPI Server
MQSeries
UCAD-Dispatch
UCAD-Router
OSS-Scheduling
Grand-Central
Oracle-DBMS
Time-Sheet Server
Marketing App.

384 kbps
DDS

Ethernet 10BT

3Com
Netbuilder

384
Kbps
DDS

DSU/CSU

DHCP Server
Windows-NT
dynamic IP
(2, 1 backup)

7012-G30- Hardware
256 Mb Memory
4.4.GB int. SCSI disk
2 Ethernet 10-BT adapters
Two four port SSA adapters
5.0 GB 8mm tape drive
Three serial, one parallel
port

7012-G30-software
AIX 4.1.4 for unlimited #
users
IBM HACMP for AIX
SNA Server for AIX
C ++ Compiler for AIX
Oracle Parallel Server

7013-J30
Dual processor PowerPc 604
512 MB Memory
2MB L2 Cache
Internal Disk: 4.4 GB SCSI-2 fast/wide hot pluggable
disk
Two 2.2 GB drives
SCSI-2 Fast/Wide I/O controller
Two ethernet 10 BaseT adapters (one active, one
standby)
Two four port SSA adapters (external disk use only)
5.0 GB 8mm tape drive
SCSI CD-ROM (600 MB)
3.5 in diskette drive
Three serial, one parallel port

7012-J30-software
AIX 4.1.4 for unlimited #
users
IBM HACMP for AIX
SNA Server for AIX
Oracle Parallel Server

Windows-NT
Call Center, HQ location
(30)

Dispatcher W/S, ABD st.
Windows-95
MDSI Windows
Dispatcher
(5)

56
Kbps
DDS

Nynex
Frame Relay
Network: Util_Co

Windows-95 for
Pen
120 Mhz Pentium
2.1Gb Disk
40 Mbyte Memory
External Modem
Truck-Mountable
Hard-Keyboard
Secure access to
Server and
Mainframe

Applications:
-MDSI-Mobile Pen
for Applications
(MPA)
-UNITE CIS,Oracle
access, C&M field

Sierra Wireless MP200

19.2 Mbit/sec, CDPD

MDBS and Antena

New England
CDPD Network
Bell Atlantic

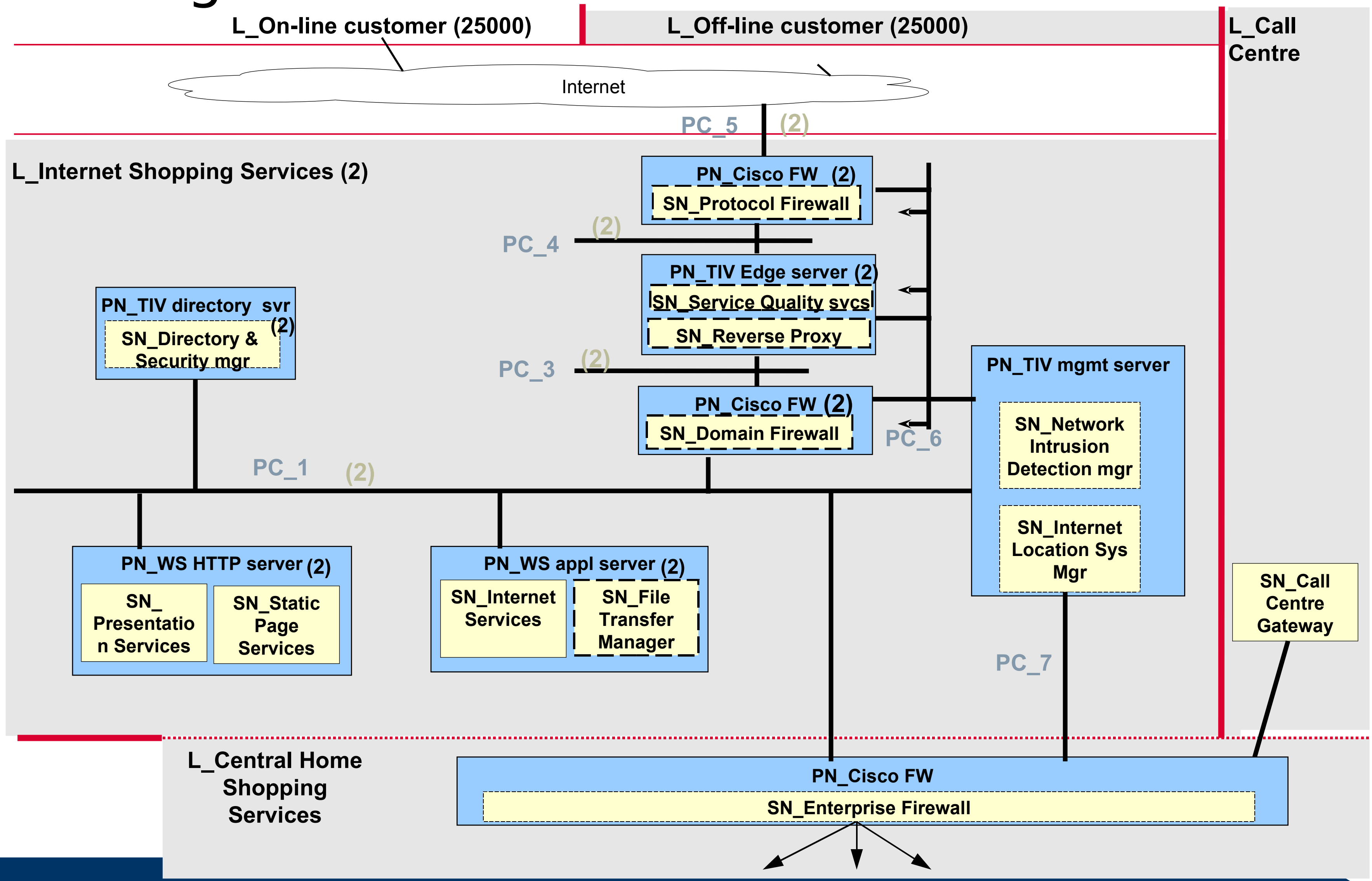
Service Rep W/S
Microslate Windows-95
(80)

Marketing Rep. W/S
Toshiba Pentium Laptops
(25)

Windows-95 for
Pen
120 Mhz Pentium
2.1Gb Disk
40 Mbyte Memory
External Modem

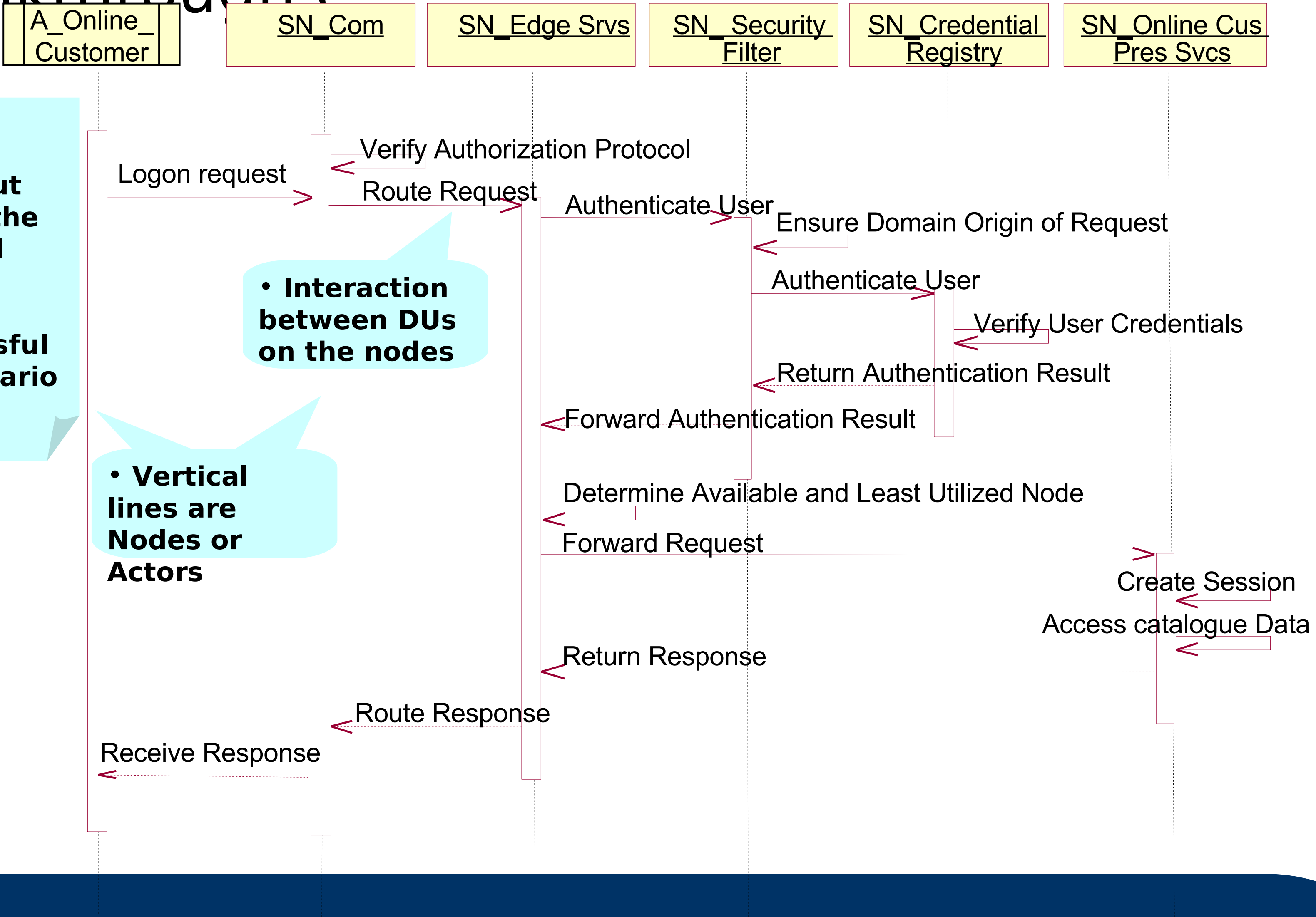
Applications:
Marketing
Application
C&M applications

Or using more formal notation ....



Validate the design by performing walkthroughs

- **This is an interaction diagram, but applied to the Operational Model**
- **A 'successful logon' scenario example is shown**



- **Interaction between DUs on the nodes**

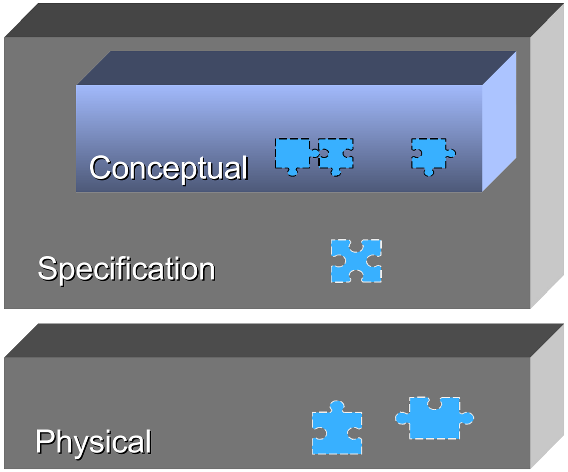
- **Vertical lines are Nodes or Actors**

Backup / detail charts

The Conceptual level of the Operational Model (COM):

Based on requirements (known to us), we shape and outline the distribution style of the solution that will deliver those requirements.

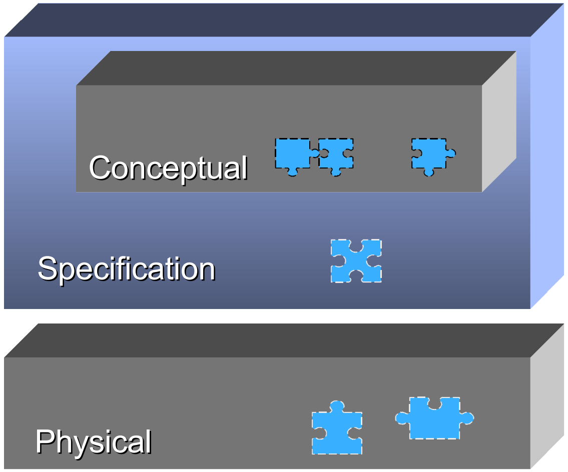
- Layer the system in locations and zones and build an outline architecture
- Identify candidate (Conceptual) Nodes and link the OM to the Component Model via DUs
- Place Presentation, Data and Execution DUs onto nodes to best deliver the requirements while remaining within the solution's constraints
- Establish end-to-end connections (Conceptual Connections)
- Assess the viability of the emerging solution architecture and refine and document our decisions



The Specified level of the Operational Model (SOM):

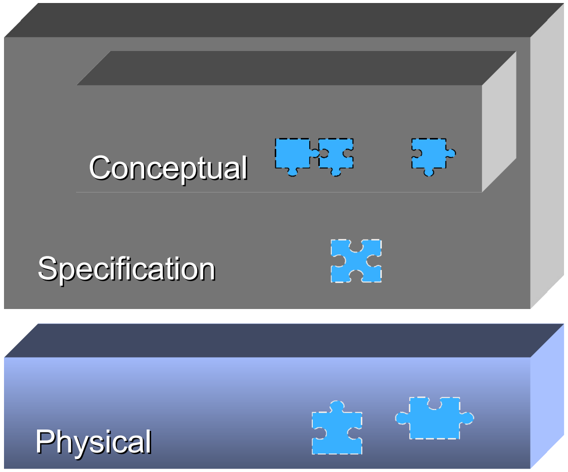
We transform the conceptual system architecture into a set of technical specifications.

- ✓ Identify technical requirements and services necessary to deliver the the business functions with the appropriate service level characteristics and within the necessary constraints
- ✓ Consider alternative ways to deliver requirements, make trade-off and restructure the architecture as needed
- ✓ Develop the network structure, route interactions to derive specified connection requirements
- ✓ Assess the viability of the emerging solution architecture and refine and document our decisions



The Physical level of the Operational Model (POM):

We select appropriate hardware and software products to fit the specified architecture and configure them to meet the NFRs.



- ✓ Select various physical hardware and software products that will be deployed in order to deliver the requirements specified
- ✓ Describe the configuration of these products, such that they can be seen to deliver the functional and non-functional requirements
- ✓ Validate that selected products together satisfy the specified requirements
- ✓ Describe how this detailed configuration must be managed to support the business application
- ✓ Assess the viability of the emerging solution architecture and refine and document our decisions