

A 3D rendering of a warehouse conveyor belt system. Several cardboard boxes are positioned on the belt, which is flanked by metal guides. Red laser lines are projected across the scene, creating a grid pattern on the floor and highlighting the boxes. The perspective is from a low angle, looking down the length of the conveyor.

Topics in Software foundations

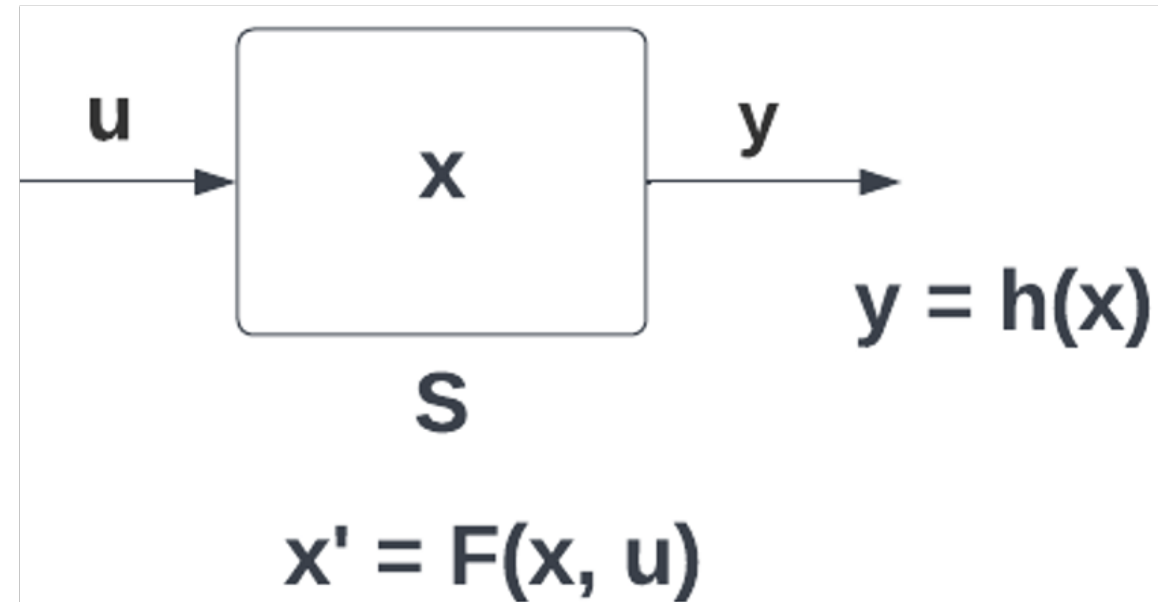
Unit 3 – Systems approach to Software Engineering

Session 1 (2023-01-16)

Recap: Transition Systems

A transition System is a tuple $(X, X^0, U, \rightarrow, Y, h)$ where


1. X is a **state space**, a set of **states**.
2. X^0 is a subset of X and is the set of **initial states**.
3. U is an **action space**, a set of **actions**.
4. Y is an **observation space**, a set of **observations**.
5. $h : X \rightarrow Y$, called the **display** maps states to observations.
6. $\rightarrow \subseteq X \times U \times X$ is called the **transition relation** or **dynamics**. The transition (x, u, x') is written $x \xrightarrow{u} x'$.



Recap: Iterative Systems

Special case of transition systems where U is a singleton (“NEXT” is the only action)

Note the similarity of such a system with the Discrete Flow (X, F) in Mapcode



What does a
software engineer
do in a software
product
company?





Your perspective

What does a software engineer do in
a software product company?



Class discussion

Imagine that you can see future 😊

You have been seeing yourself perform in your first company after college – first 6-9 months of your work.

Answer the following questions based on what you see.

Questions



What skills and courses (that you learned in college days) are helping you the most?



What skills your manager expected you to have but you didn't have (or had less than expected)?



What problems are you solving for your company?



On what basis is your manager evaluating your performance? What is important for them?

Share your thoughts

Modern Application Software and its development

A large, distributed, interactive system composed of multiple subsystems (services)

Delivered as a 24/7 available service

Fast release cycles, often weekly or less (in addition to monthly or quarterly ones)

Quick response cycles from customers (often within hours when things go wrong!)

Engineer managing end to end development cycle for their delivery

Infrastructure as code

What is expected of a new engineer?

Comprehend the existing software system and keep the comprehension current

Take end to end responsibility (design, develop, test, deploy, support) for their work


Account for existing system behavior when designing enhancement or defect work.

What makes a fresh engineer valuable in first 12-18 months?

Work well in a team and communicate well.

Solve design problems

Demonstrate quick learnability for existing product



My
experience
with fresh
hires

Good at algorithms and programming, not good at grasping systems

Always willing to create from scratch, not willing to understand existing code to enhance/fix it

Lack design and modeling skills, ability to communicate and discuss their design is lacking too

A collection of various geometric shapes and patterns. The shapes include circles, squares, triangles, and lines. Some shapes are filled with color (teal, yellow) and others with patterns (dots, stripes, zig-zags). The shapes are scattered across the page, with some overlapping. The text "do in" is visible in the bottom left corner.

A collection of various geometric shapes and patterns. It includes a grid of dots in the top left, a teal circle with wavy lines in the top right, a 3D rectangular prism with a dotted top and striped sides in the center, a teal square with wavy lines on the left, a teal circle with a single line on the right, a 3D L-shape in the bottom left, a 3D cross with a dotted top in the bottom center, a 3D triangle with a striped side in the bottom right, and several other shapes like circles, triangles, and lines with different patterns and colors.

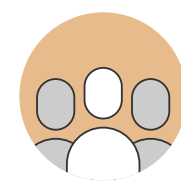
Where we are | Today and Beyond



#1 software for salons,
spas, medspas, & fitness
centres



12,000 business in over 50
countries



Over 800 people in
9 locations



Zenoti acquires
SuperSalon to
consolidate leadership
in salon and spa
software.



Focused on large
enterprises & multi-
location SMBs



\$290 million in funding –
raised \$160M in series D
funding to surpass \$1B
unicorn valuation



Our investors include:
Accel, Avataar Ventures,
Tiger Global, Steadview,
Advent International, TPG

Our Presence:



BELLEVUE (HQ)



HYDERABAD



KUALA LUMPUR



JAKARTA



MANILA



BRISBANE



DUBAI

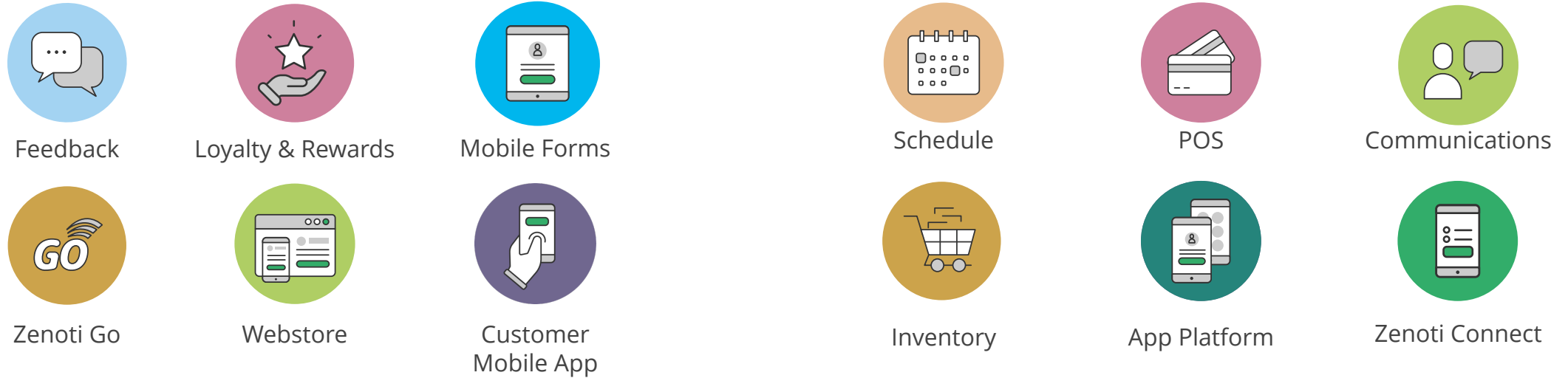


TORONTO

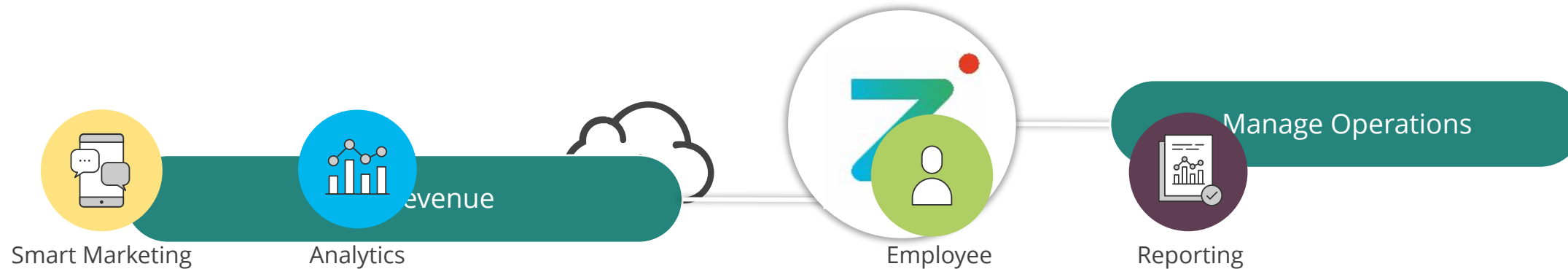


UNITED KINGDOM

Why Zenoti? | A Comprehensive Product



Elevate Guest Experience



Reliable Cloud Infrastructure

An Example | Complex Businesses



Leading brand. 30+ years. 14 locations.
30 person call center. 100 receptionists. 1,000+ stylists

RECEPTION

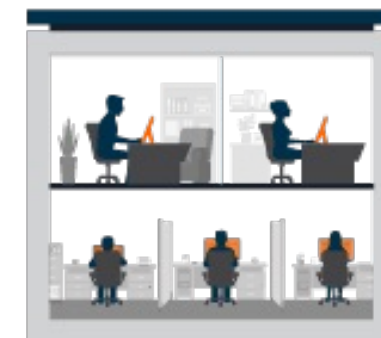
Check-in/check-out =
10-15 mins

PROVIDERS

Coordinating upsells
with front desk

CORPORATE

Lost sales, customer
engagement, network
management.



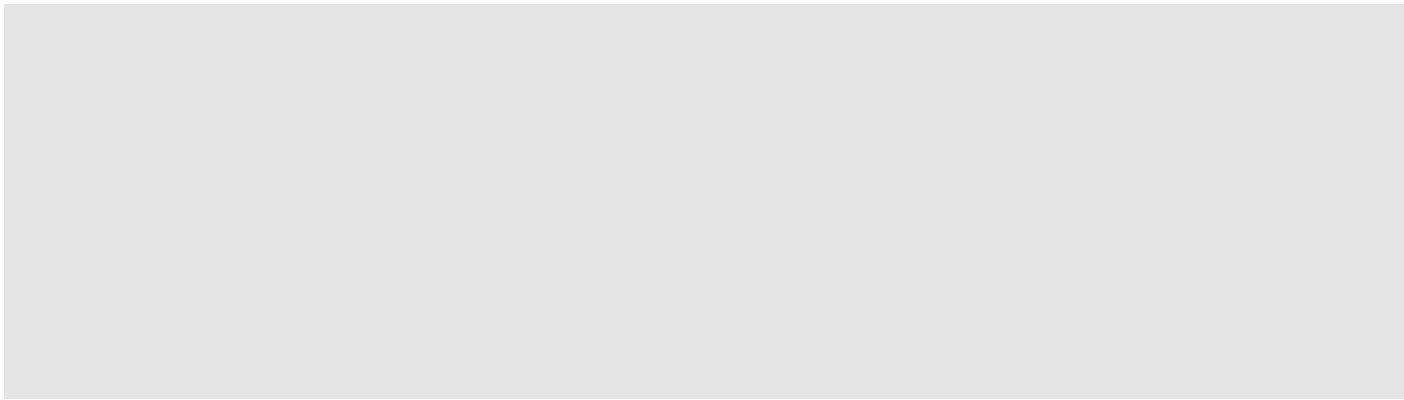
CALL CENTER

Coordinating upsells
with front desk



Complex operations use up bandwidth of talent & management & stunt growth.

How do you quickly understand
a large, complex software?



Is this a skill?



My key insight

Industry builds systems (without thinking in systems), students learn programs and algorithms

What is a system?

A **system** is a group of interacting or interrelated elements that act according to a set of rules to form a unified whole.

- Wikipedia

Principles we believe in

Complexity arises from richness of behavior



Behaviors arise out of interactions



Component and system interconnections are important to comprehend



Systems need to be understood top-down



System decisions impact behavior, code doesn't track this.
Code comprehension is not enough for system comprehension



Let's try to think of software as systems, and model them as such!

A simulation (product mockup)

<https://mrityunjaypalash.github.io/gridwalk/grid.htm>

New system (video)

The goal of this feature is to allow users to see product videos and get more interested in buying the product. A new tab called 'Videos' should be available on the product details page. When user navigates to this tab, it should show a set of user videos available for this product. User can select a video to be played in the video playing area at the bottom of this tab. User should be able to stop a playing video and select any other video they like to play

<https://www.amazon.in/dp/B0BBN56J5H>

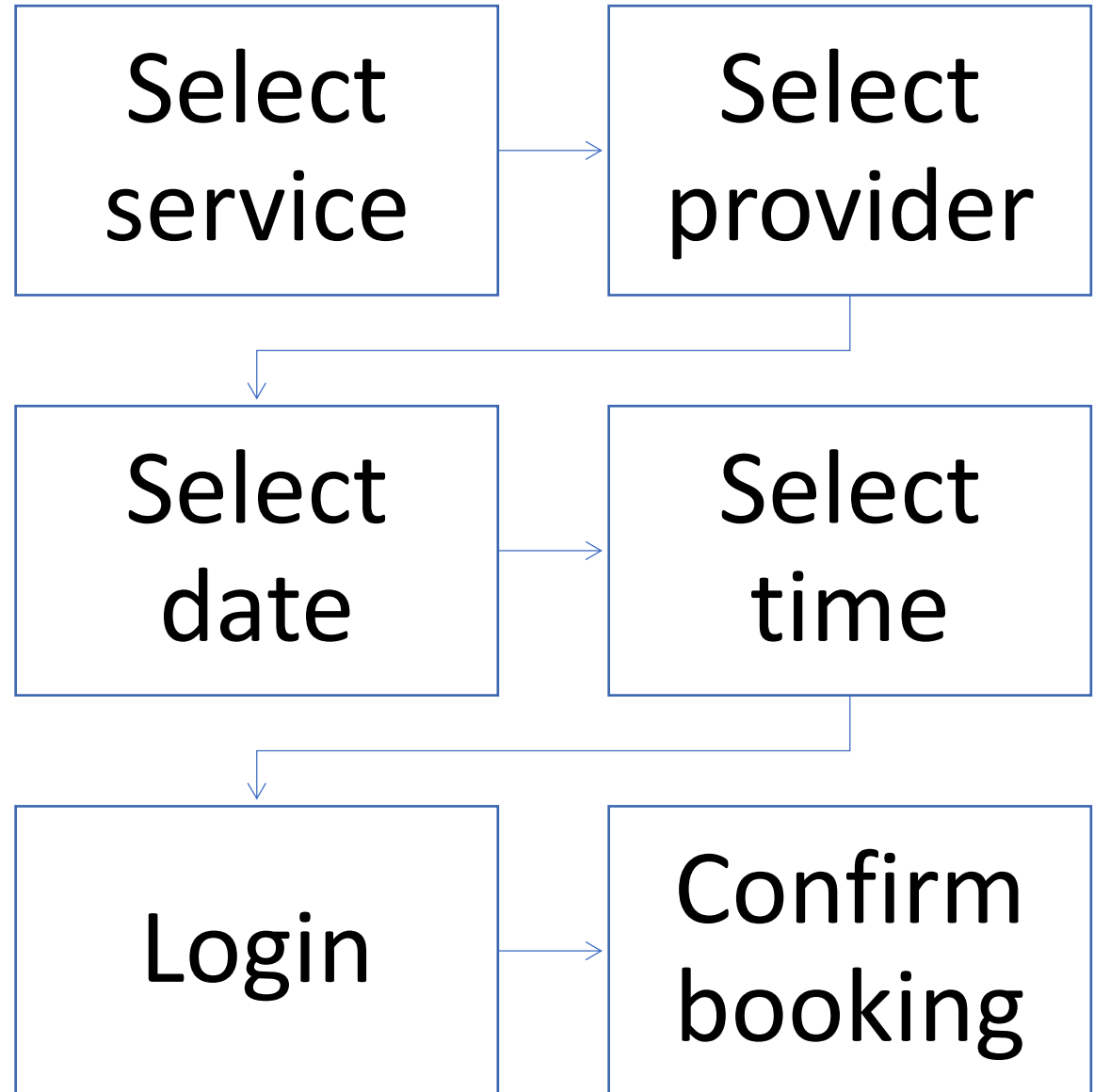
Analyze an existing system

<https://todolistme.net/>

Analyze a large system (focus of the course)

zenotispasalon - Online Booking

Booking Flow



What does an appointment depend on?

- Service
- Provider availability (Barber, Stylist, Masseuse)
- Availability of product required (Hair color, shampoo, for ex.)
- Availability of other resources (Chair, Room, any required equipment)

What kind of system is this?

One-Shot Booking System

(User provide complete information about Service, Provider, and Date/Time in one go)

Vs.

Interactive Booking System

(User provides information in pieces and gets feedback about the choice before proceeding)

Fun homework - Review
other software products
and try modeling their
behavior!



Unit 3 Learning Objectives

Analyze the behavior of a working software system and model it using Transition Systems

Understand a large system as a composition of small systems and be able to model the interconnects of systems

Successively refine the TS model when new inputs are available through hypothesis testing, Q&A, expert opinion, documentation, etc.

Use transition systems models when designing enhancements in existing (or new) system

What we will cover (8 sessions)



SYSTEM MODELING
BASICS



CODE
COMPREHENSION
BASICS



SYSTEM
COMPOSITION



ANALYSIS TECHNIQUE

- We will have workshop style sessions, you work in groups of 2 and present to rest of the class.
- Some lecture sessions to introduce the basics.

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Questions?

