

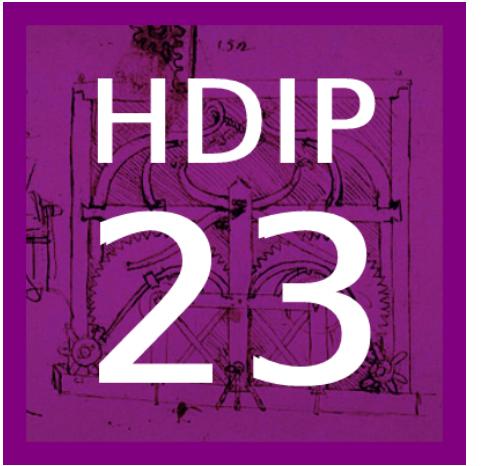
Waterford Institute of Technology  
INSTITIÚID TEICNEOLAÍOCHTA PHORT LÁIRGE



# Higher Diploma in Science in Computer Science

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2023-2024



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*Programming*

# **Agenda**

1. Context & Objectives

2. Programme Structure

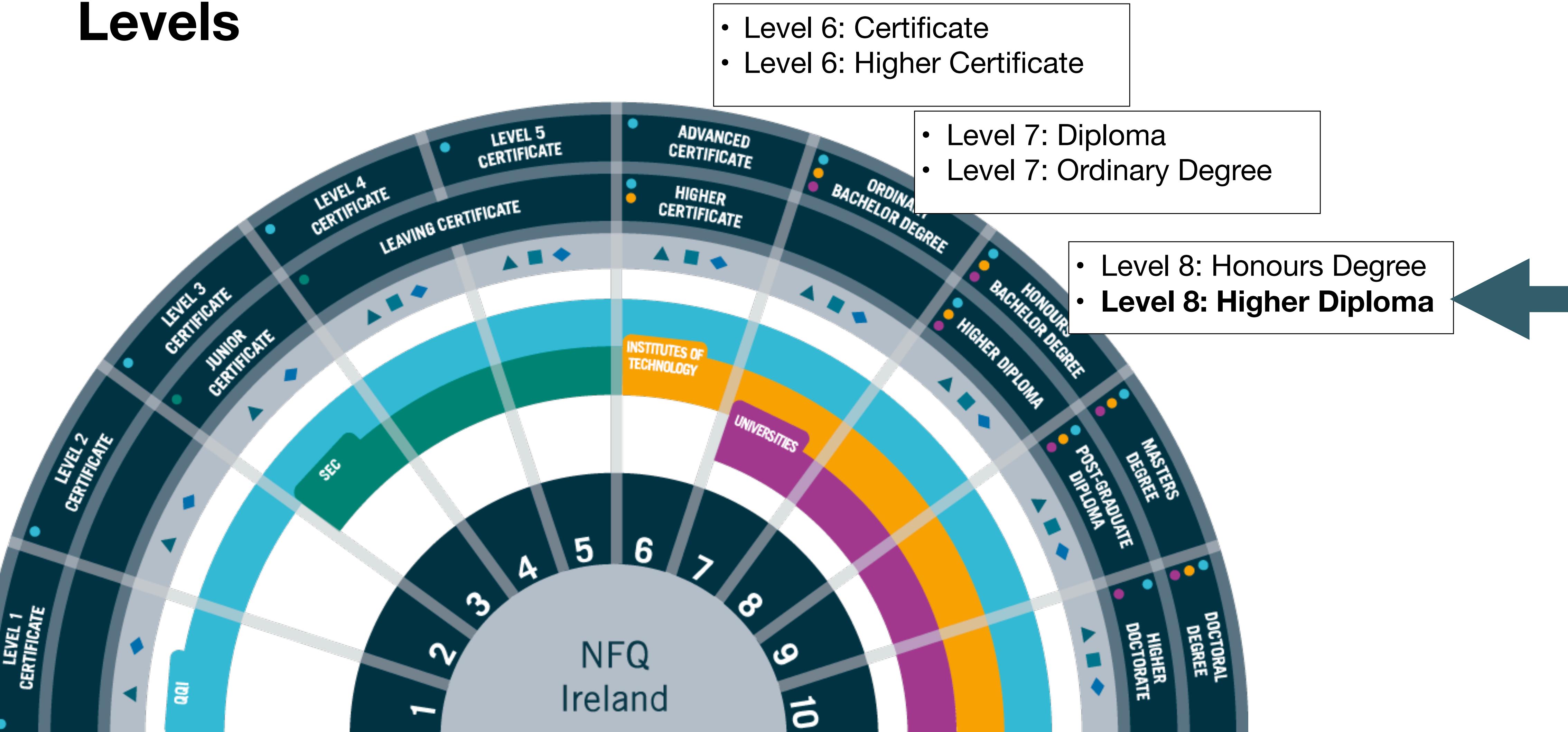
3. Semesters & Modules

4. Calendar, Timetable & Assessment Sequencing

5. Module Summaries

# 1. Context & Objectives

# National Framework of Qualifications / Levels



<https://nfq.qqi.ie/>

5

|                         |                             |                            |                          |                     |
|-------------------------|-----------------------------|----------------------------|--------------------------|---------------------|
| ADVANCED<br>CERTIFICATE | ORDINARY<br>BACHELOR DEGREE | HONOURS<br>BACHELOR DEGREE | MASTERS<br>DEGREE        | DOCTORAL<br>DEGREE  |
| HIGHER<br>CERTIFICATE   |                             | HIGHER<br>DIPLOMA          | POST-GRADUATE<br>DIPLOMA | HIGHER<br>DOCTORATE |

# Key Programme **Features**

- Immersion
- Specialisation
- Industry Partnership

# Immersion in Computing Knowledge



*“The participants will be **graduates** who have already obtained significant **transferable skills** by comparison with other undergraduate students...”*

*“Semester 1 participants will undertake a broad immersive set of modules in the **fundamentals** of computing...”*

*“The **pace** of delivery will have to be **significantly higher** than for normal undergraduate programmes...”*

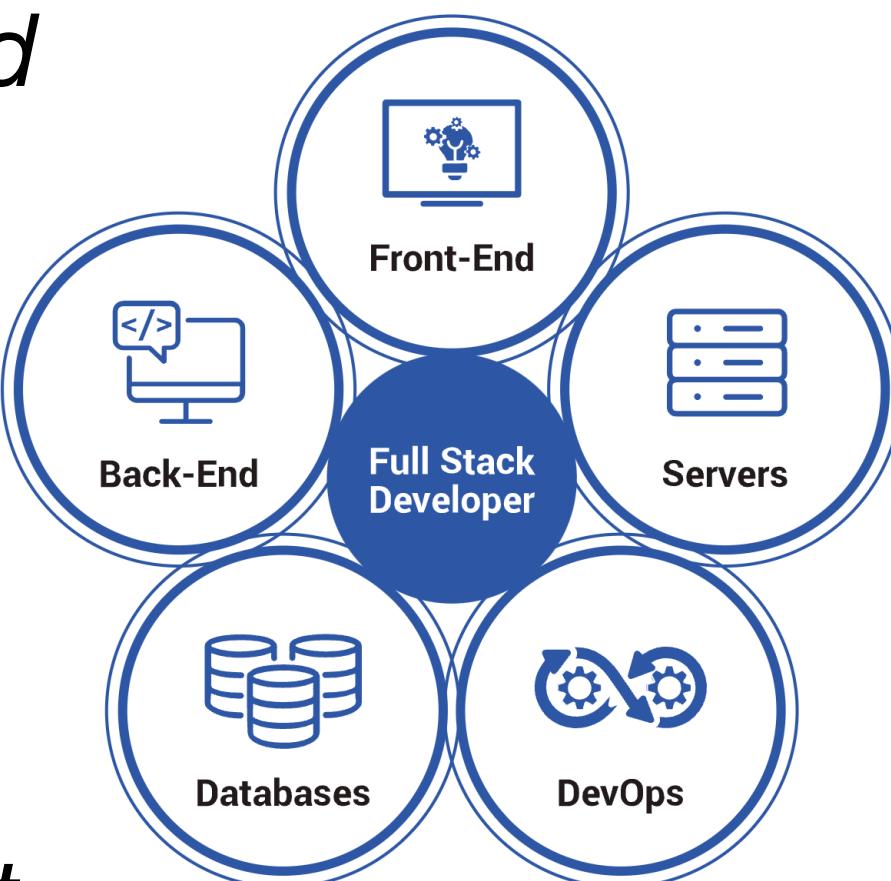
## Deepening and Specialisation



*“In semester 2 ... a **specialisation** which reflects their own strengths as demonstrated on the programme to date...”*

*“.. a focused set of modules and project-work designed to bring candidates quickly to the industry entry standard ...” **Junior Software Developer (Full Stack Oriented)***

*“Participants will be expected to select their specialisation based on their achievement in semester 1 and their own ambitions...”*



# Industry experience and professional development

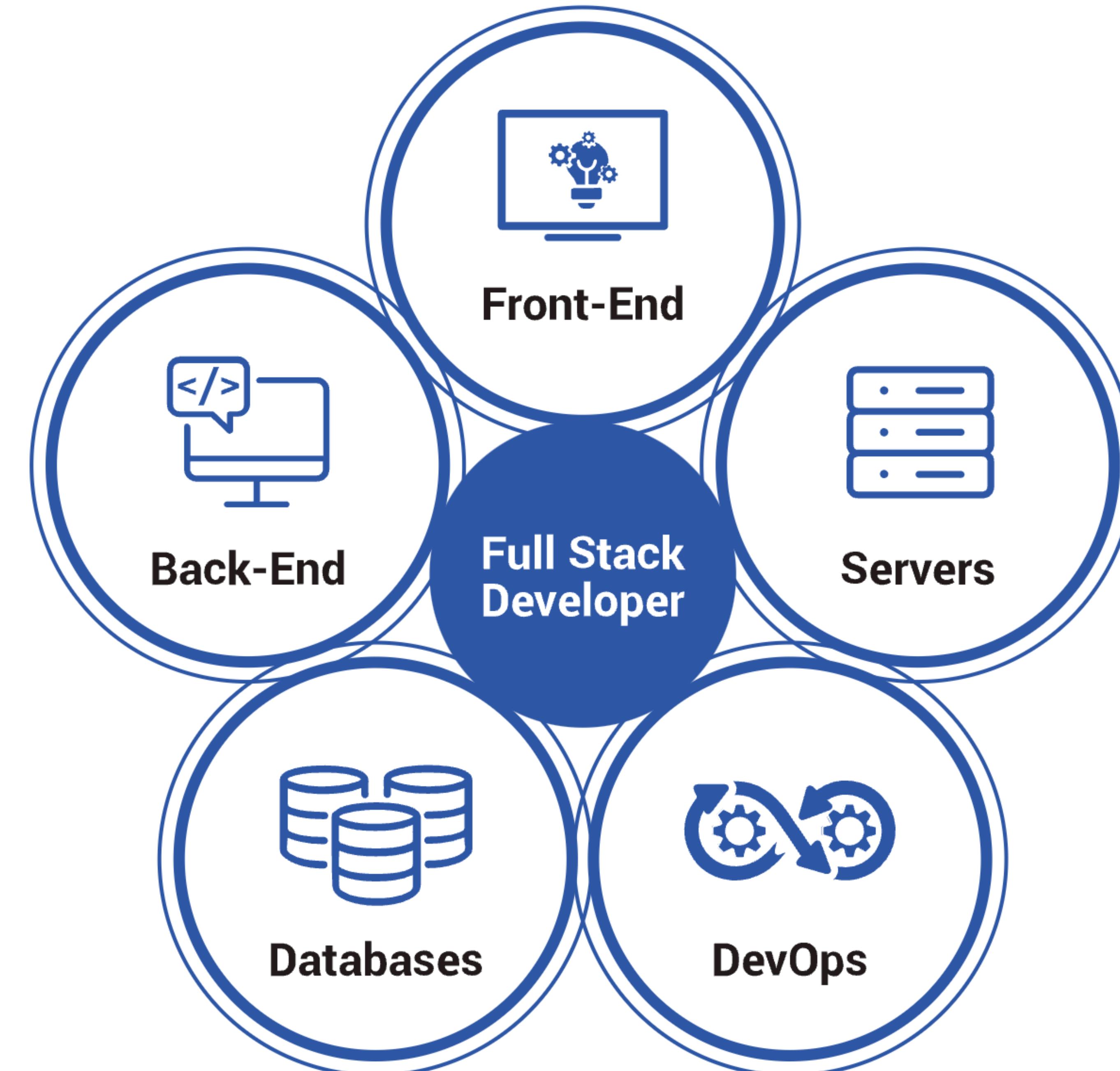


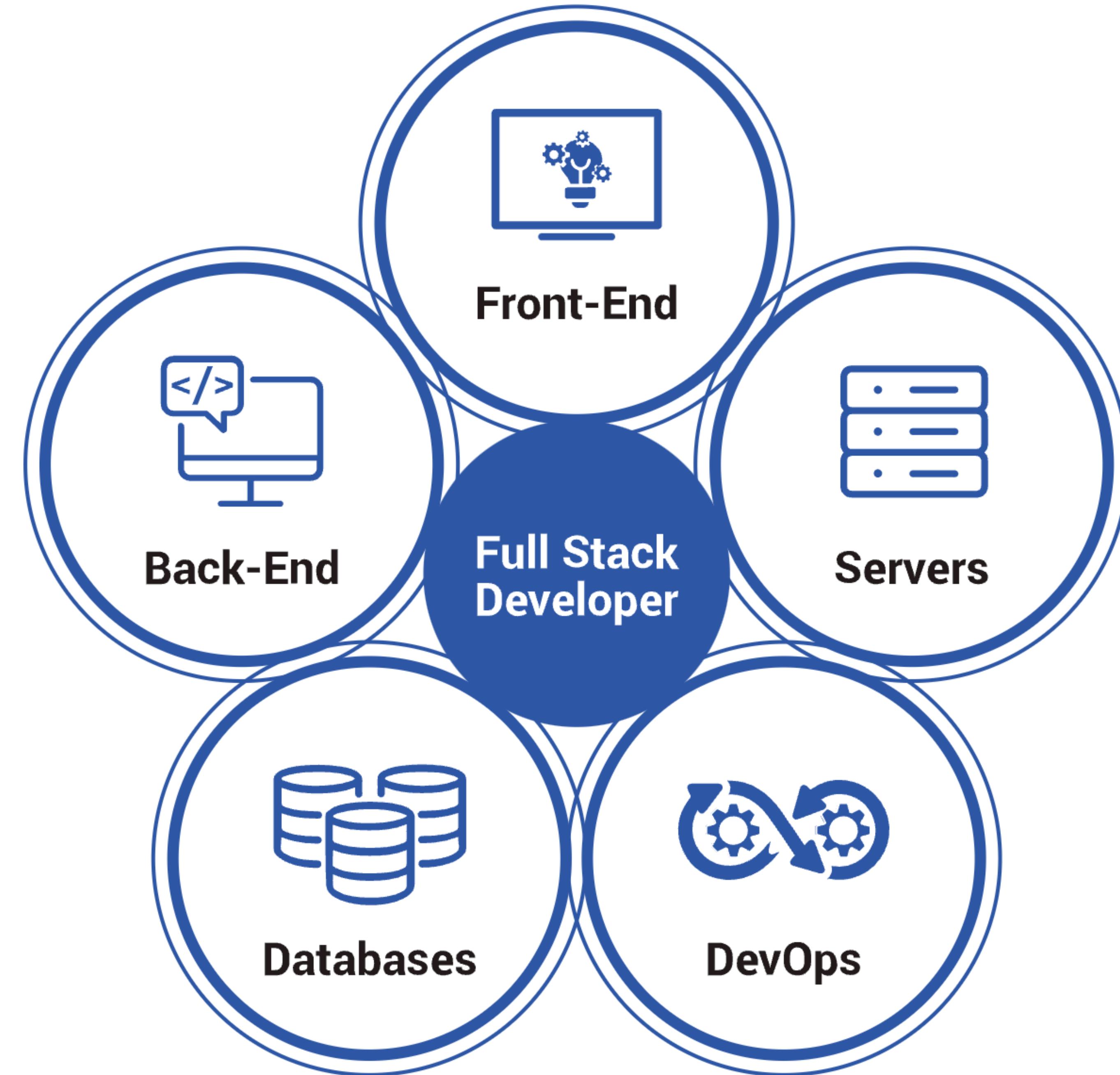
***“Internships or work placements are seen as crucial to providing graduates with the context and confidence in their new knowledge...”***

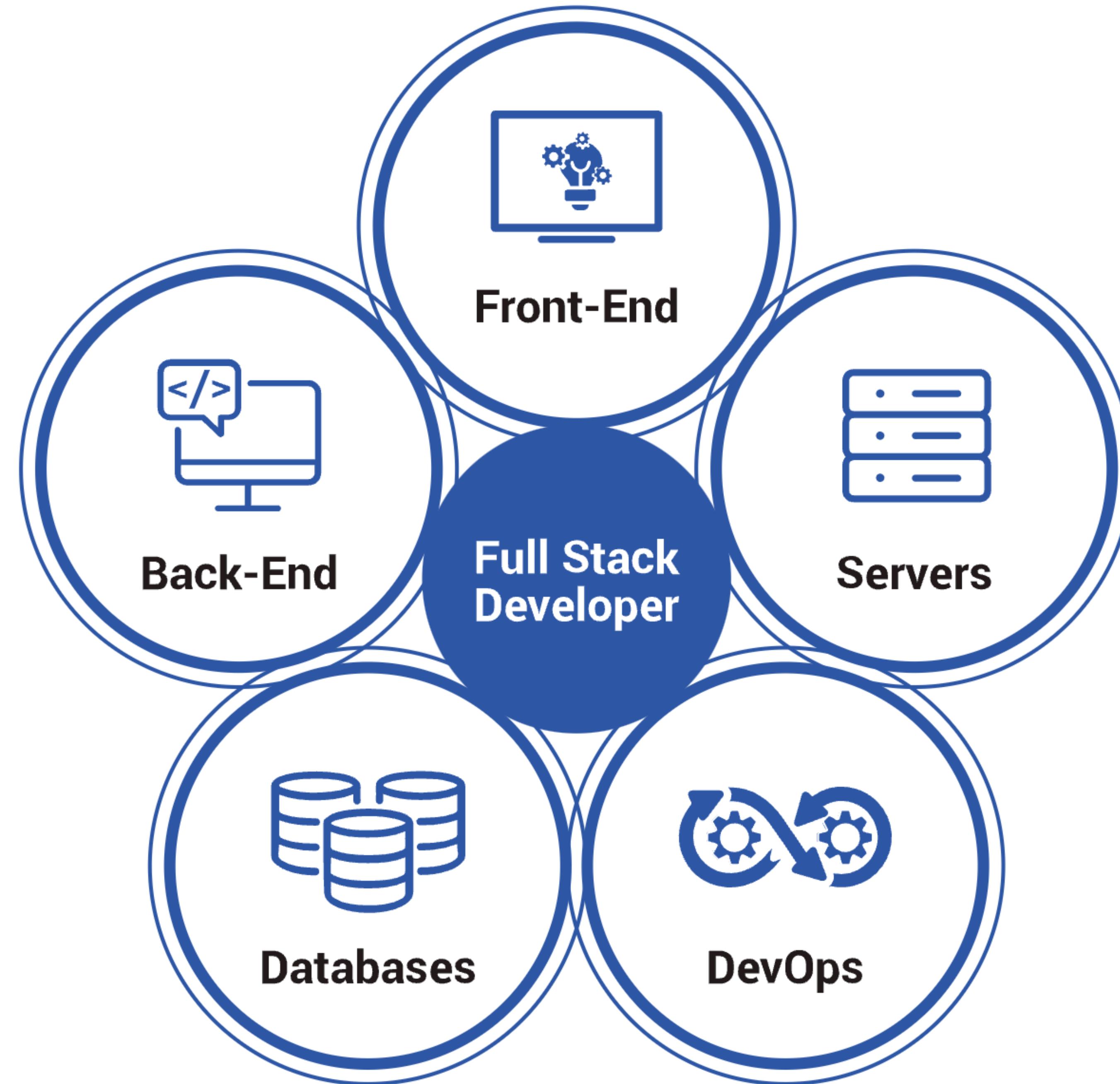
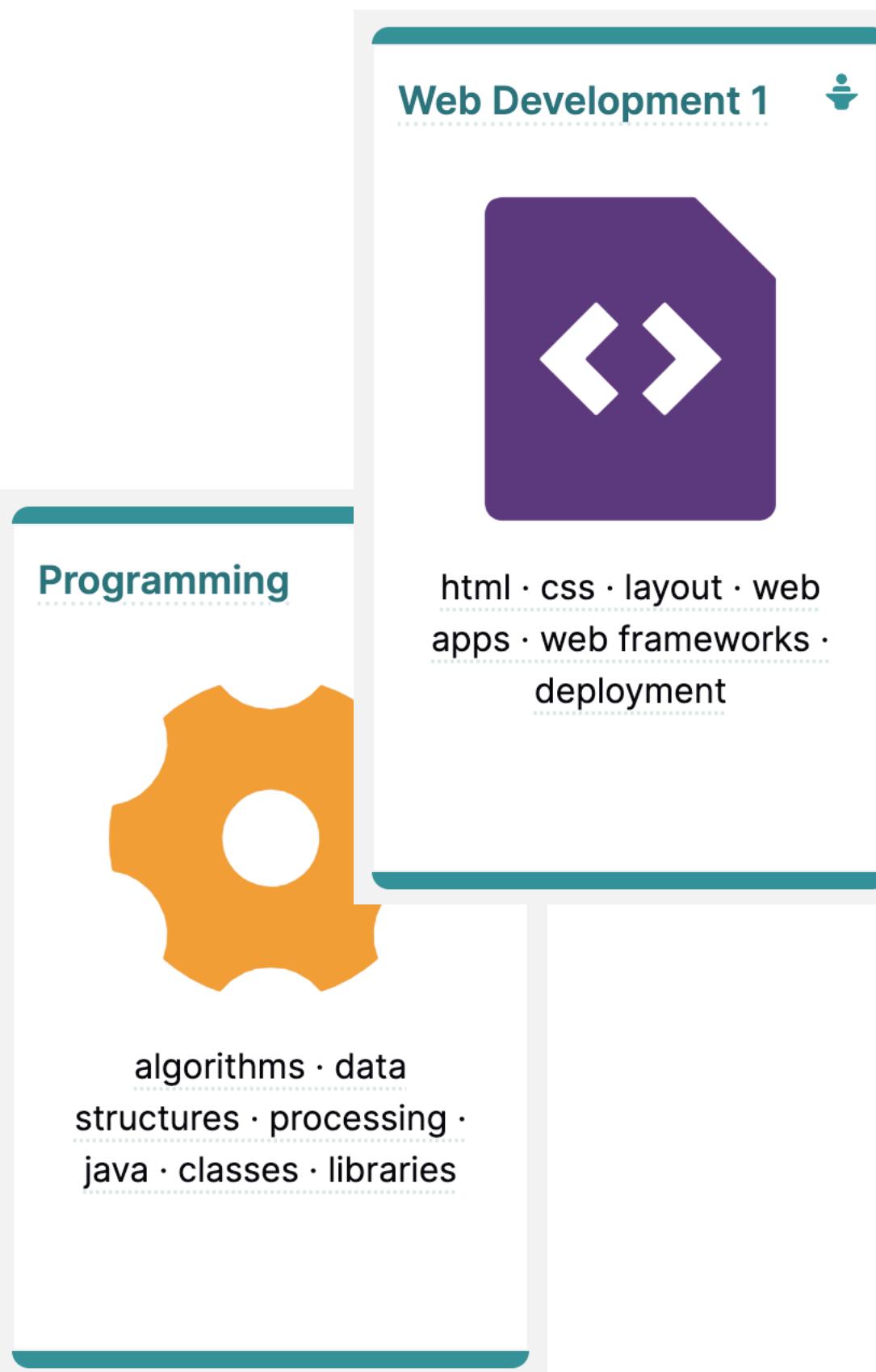
***“Outputs expected from the work placement would include a work placement report, a project ideally conducted in the work placement organisation...”***

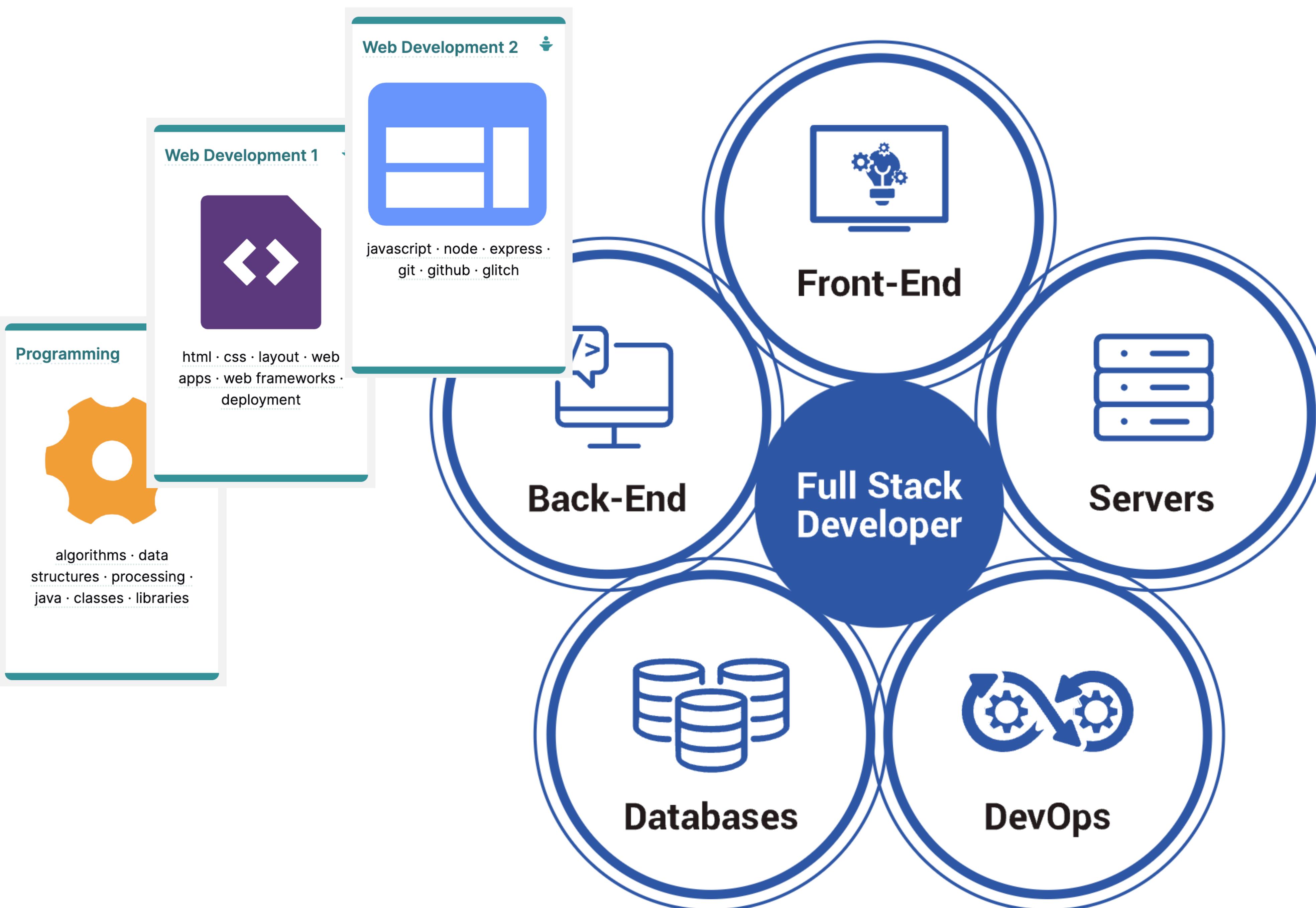
***“...academic and industry partners will cooperate in the provision of appropriate academic supervision resources for the duration of this work placement activity...”***

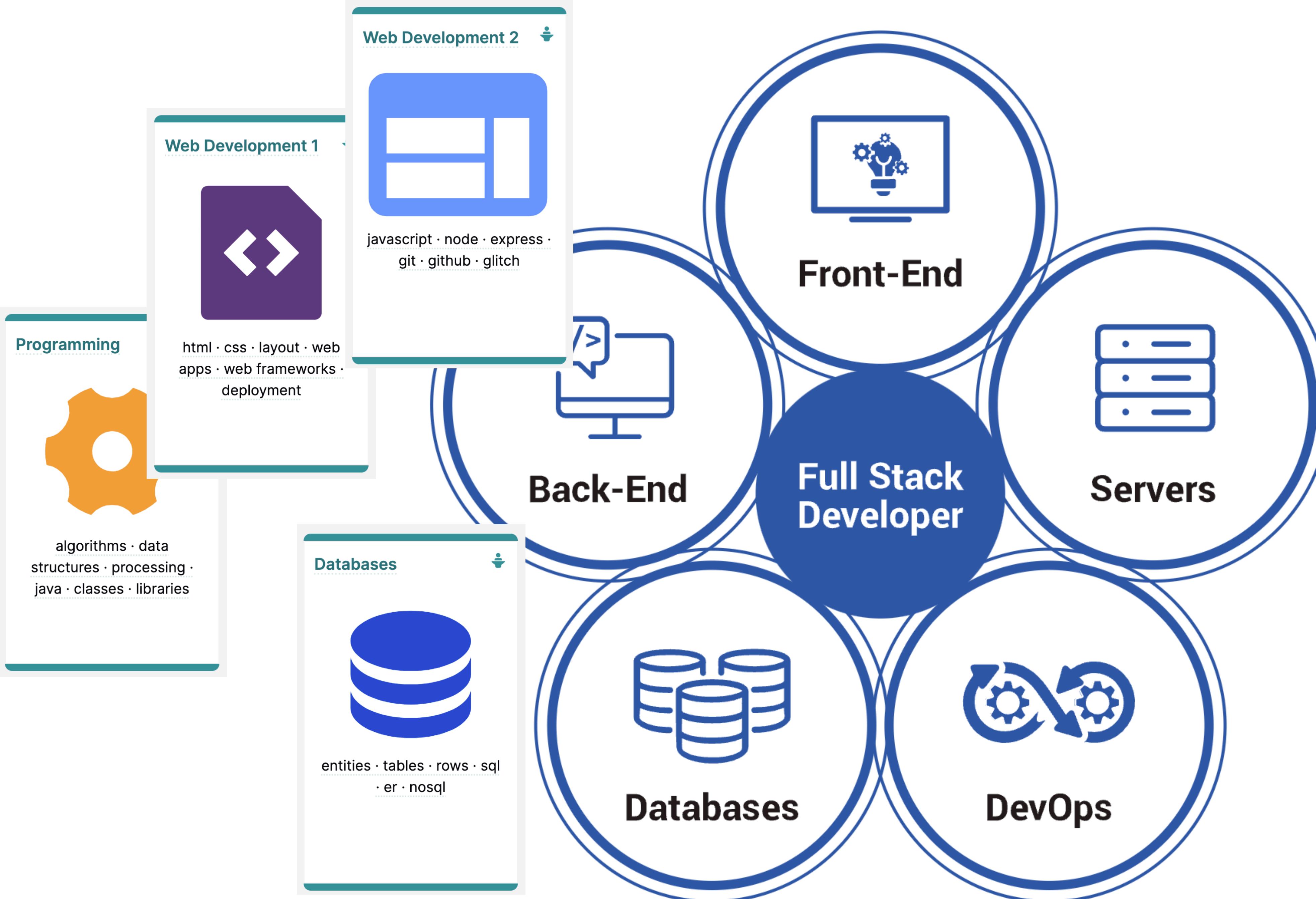
## 2. Programme Structure

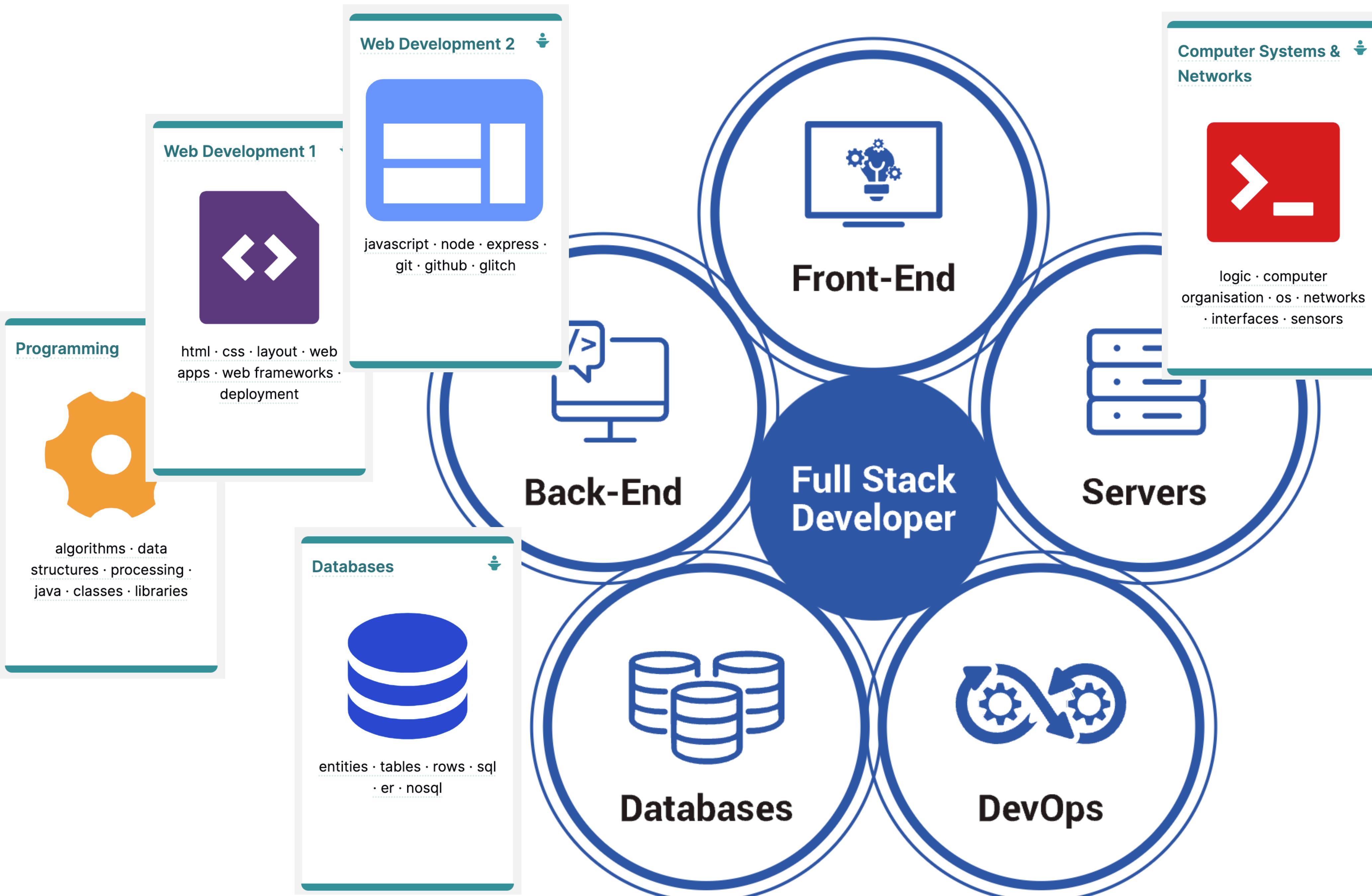


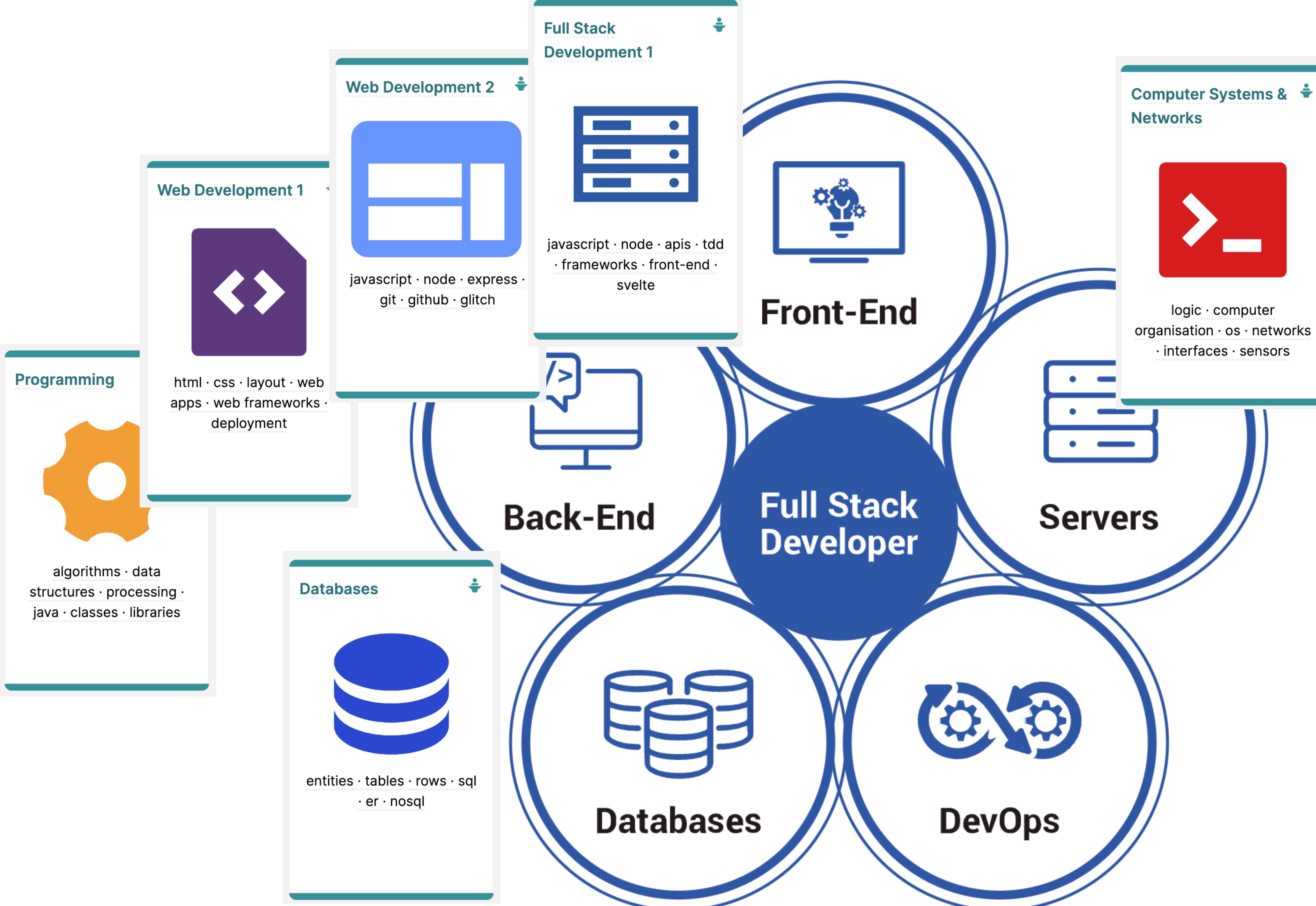


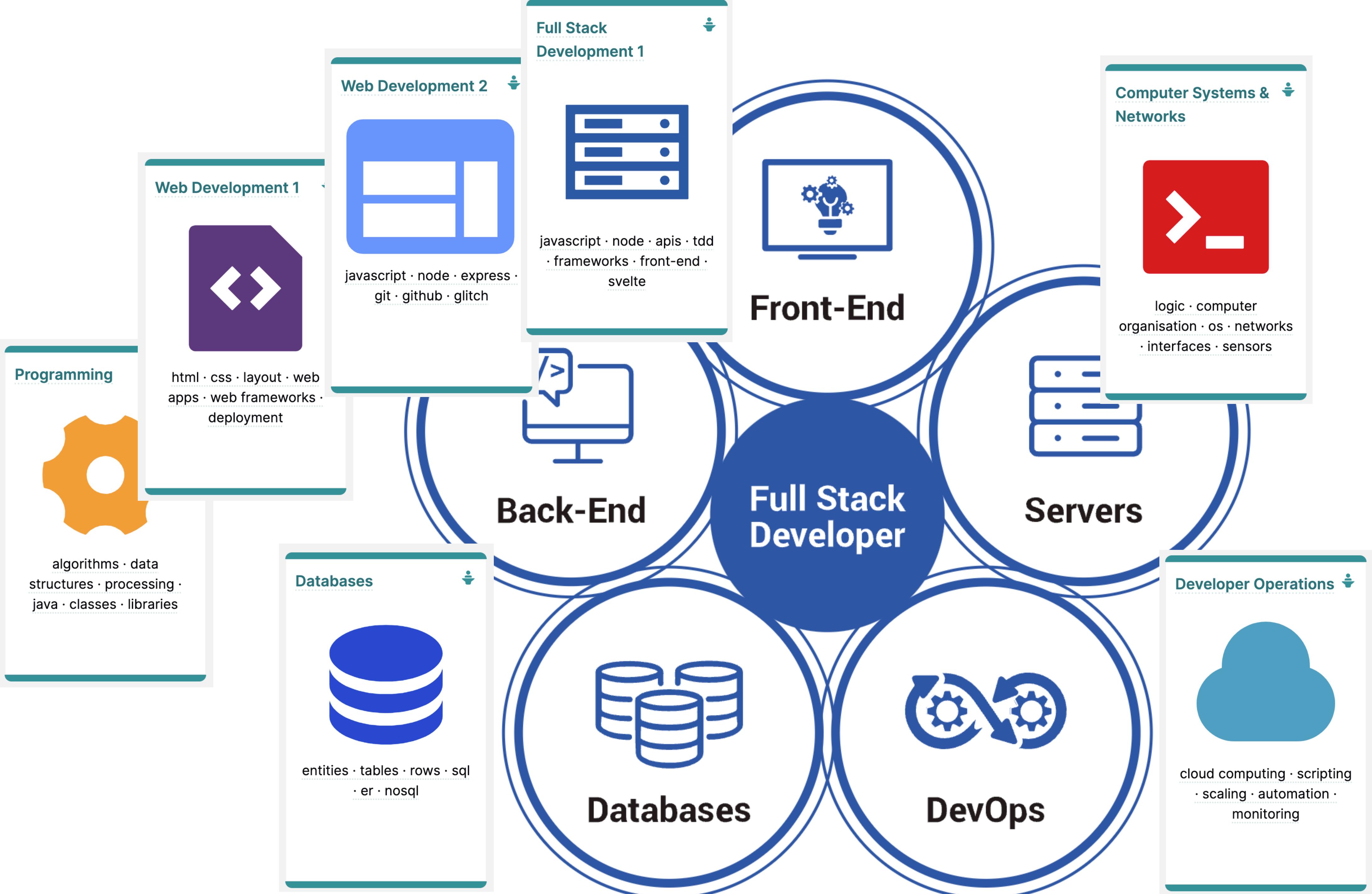


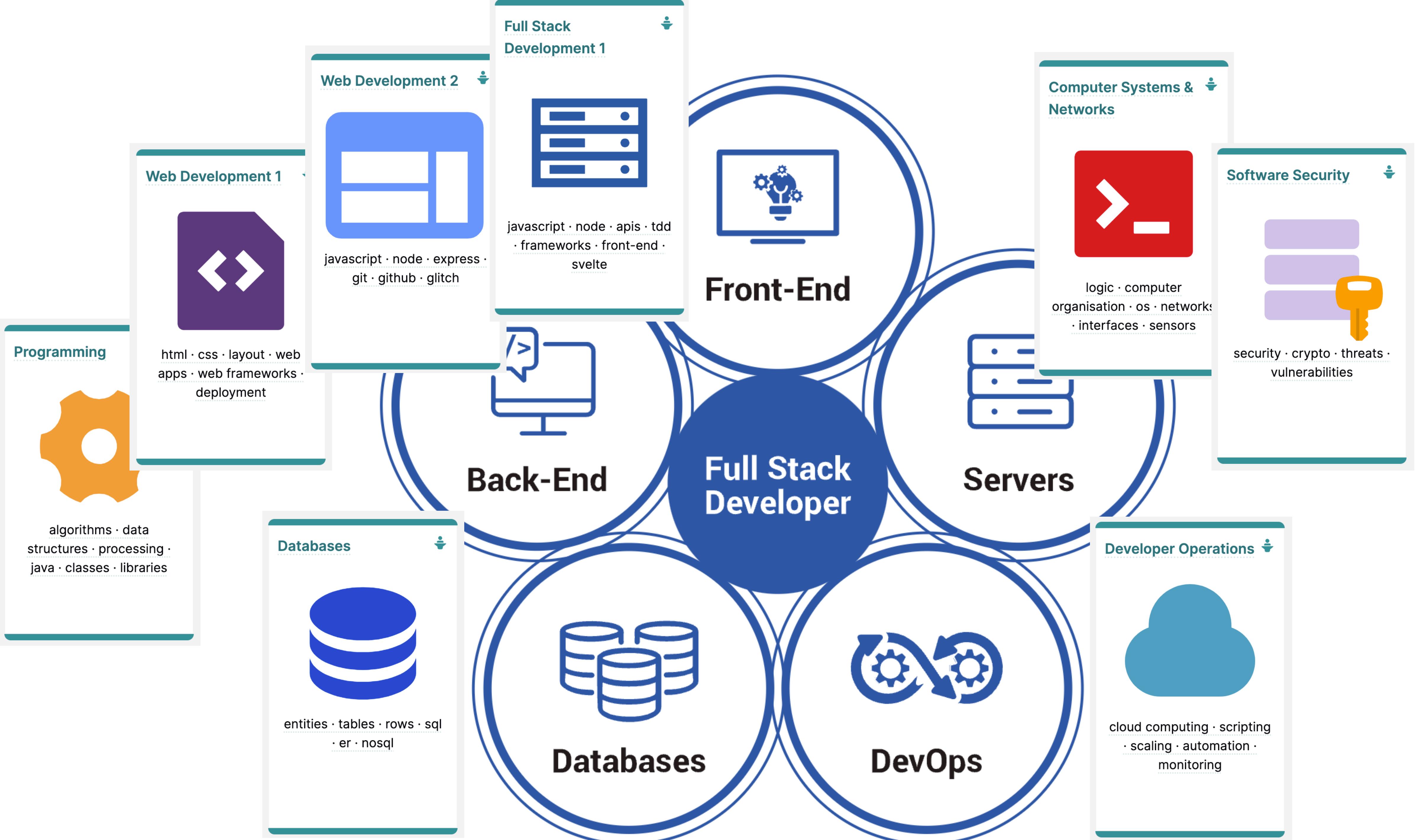


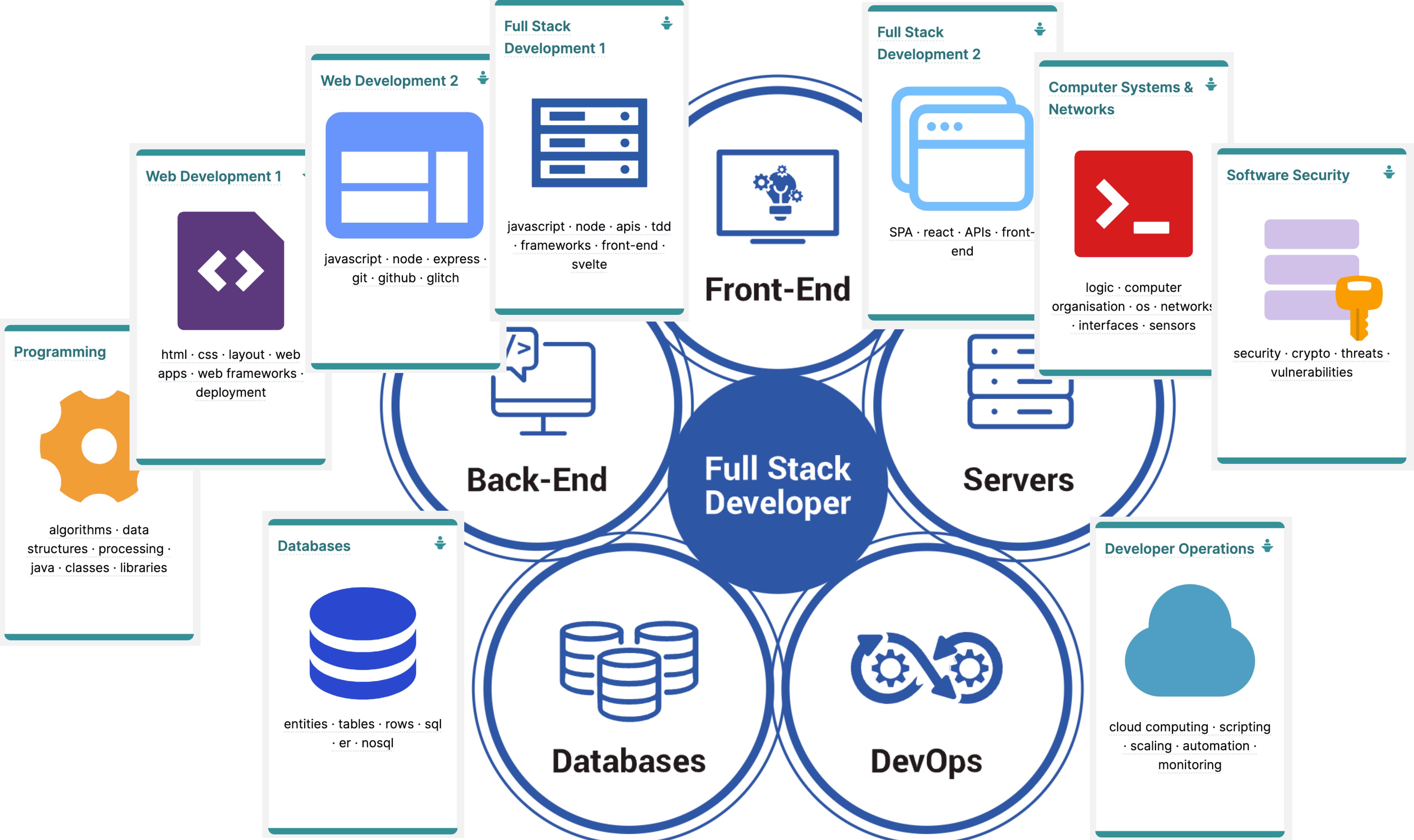


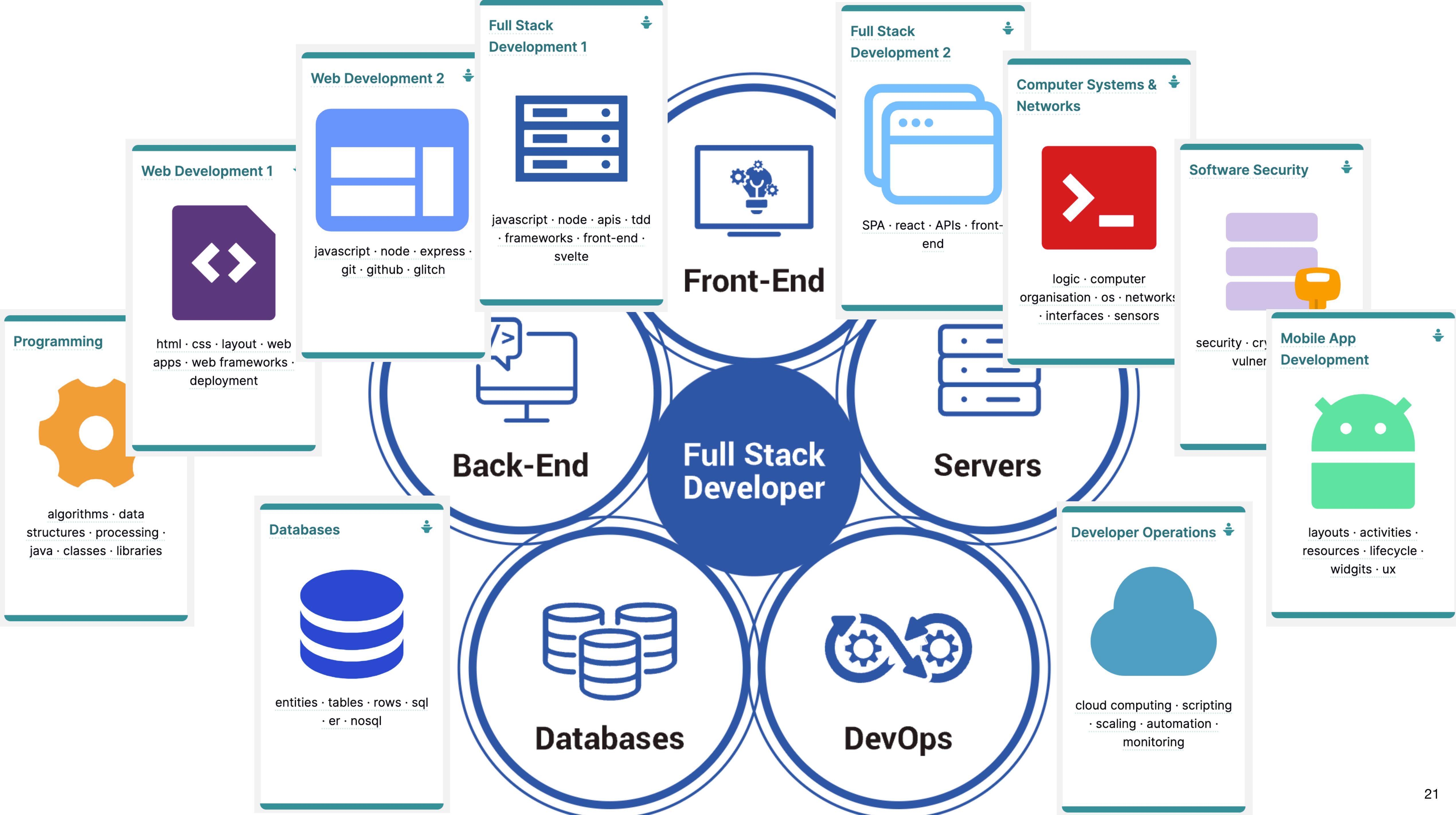


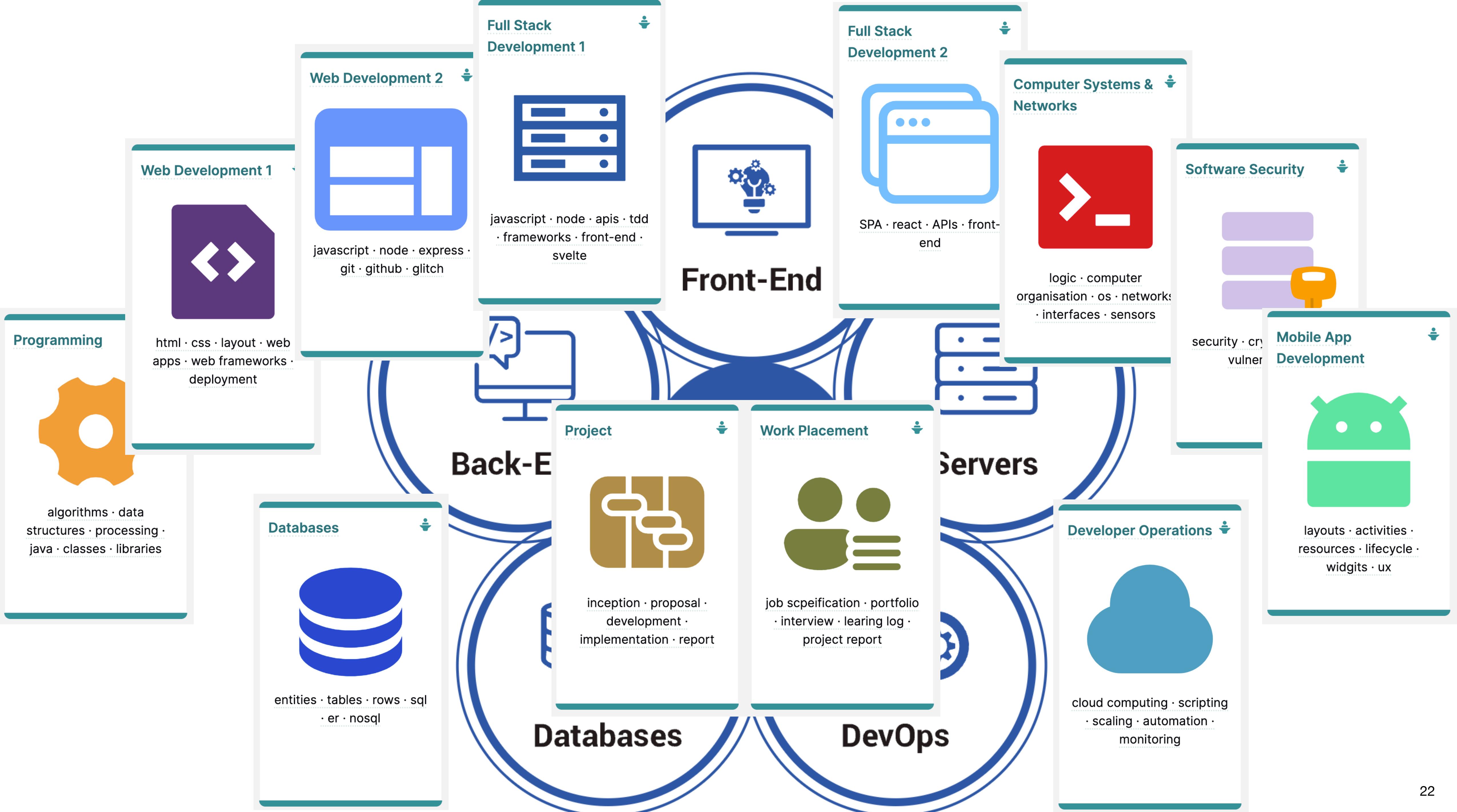


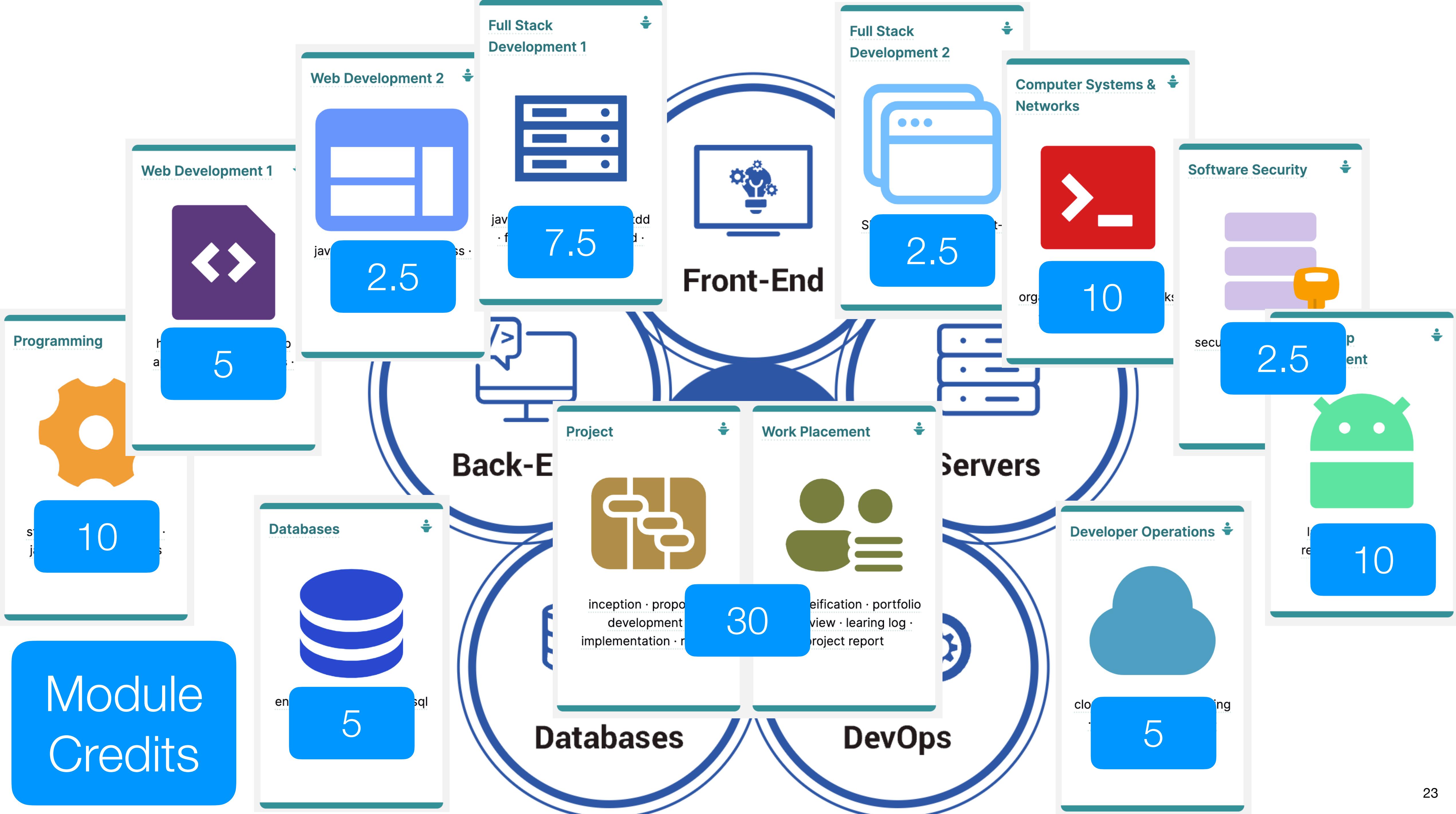




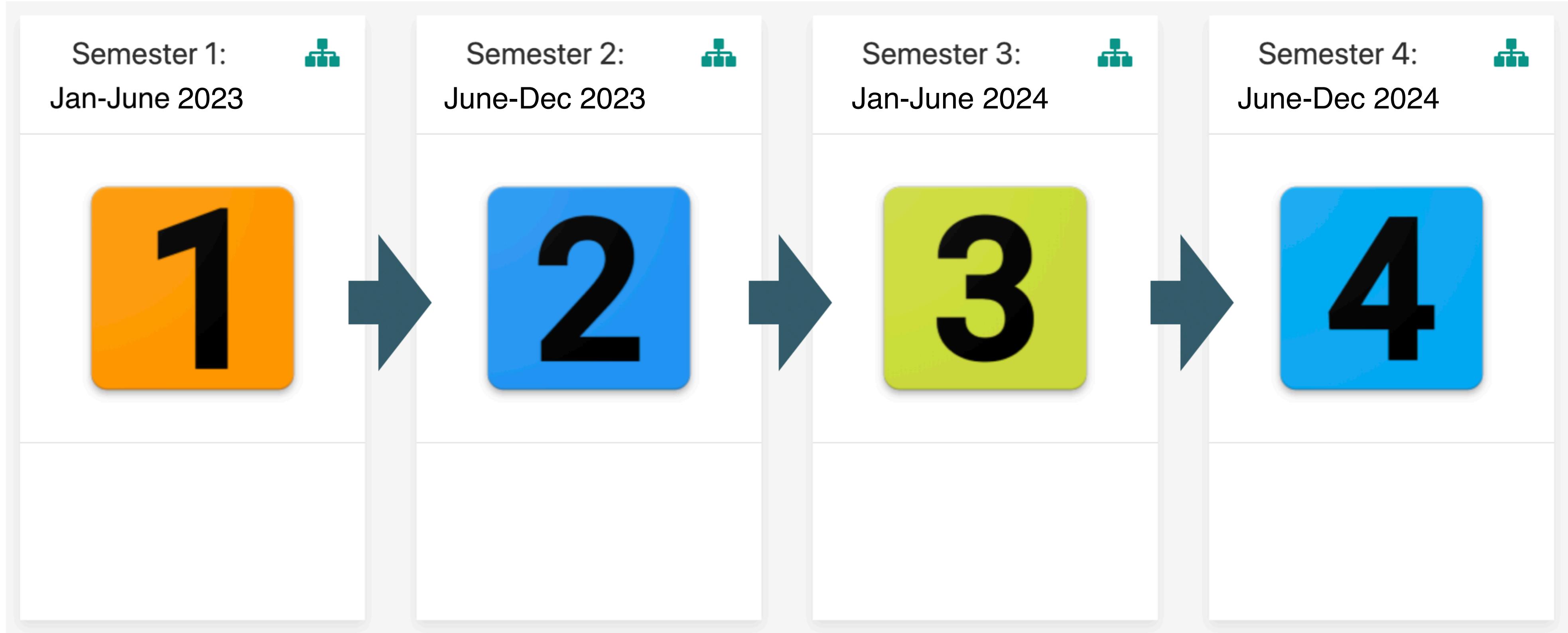








### 3. Semesters & Modules



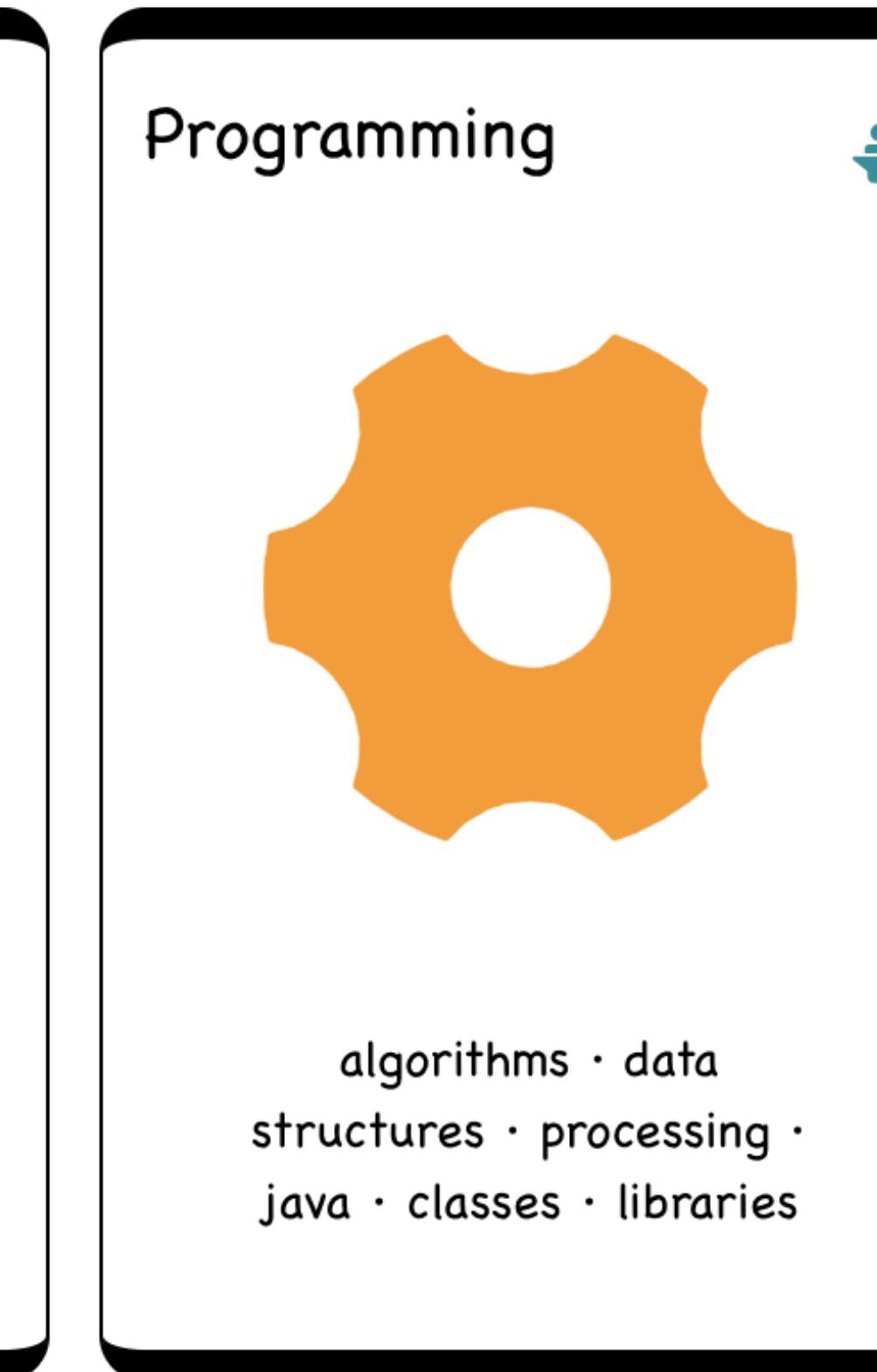
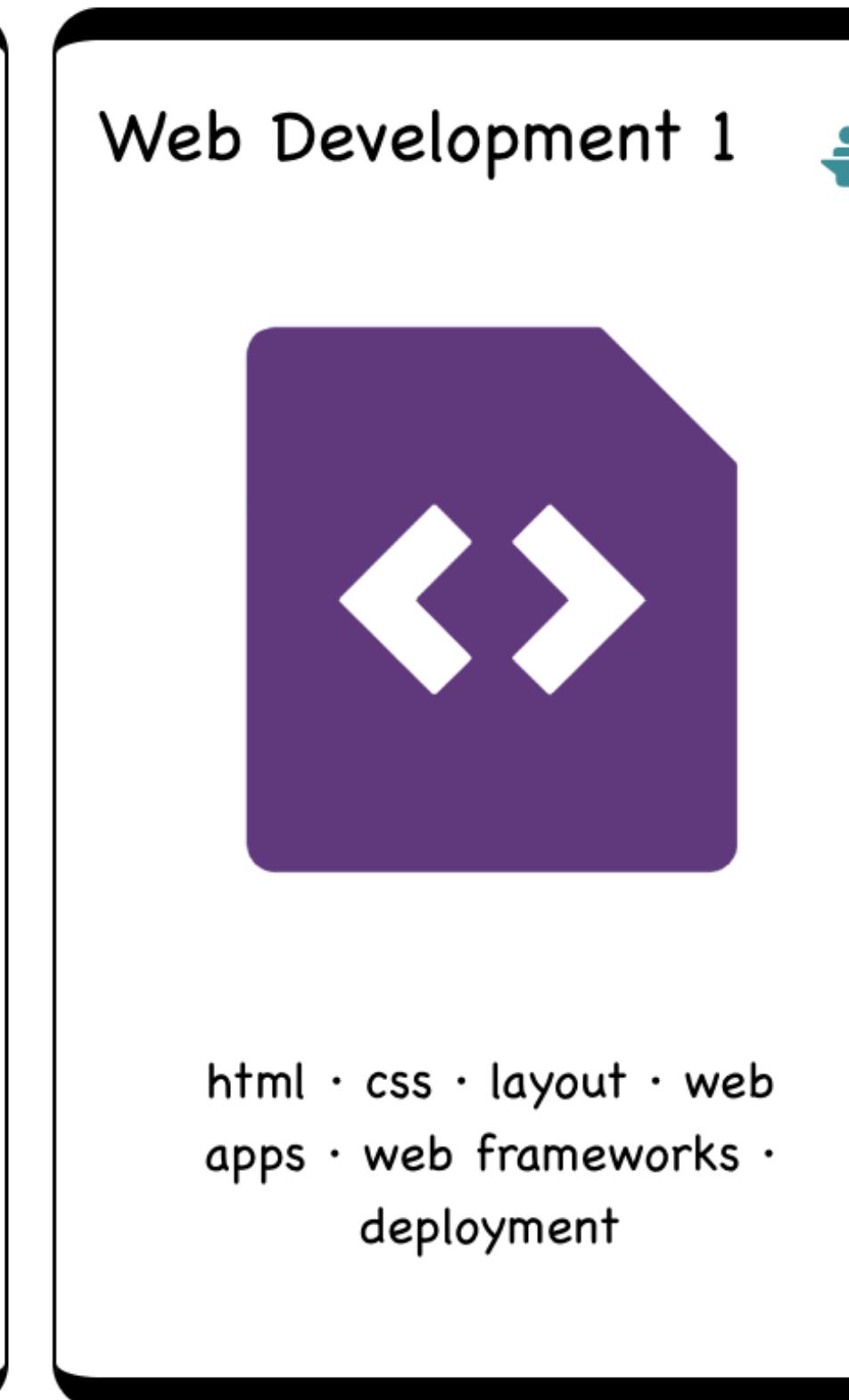
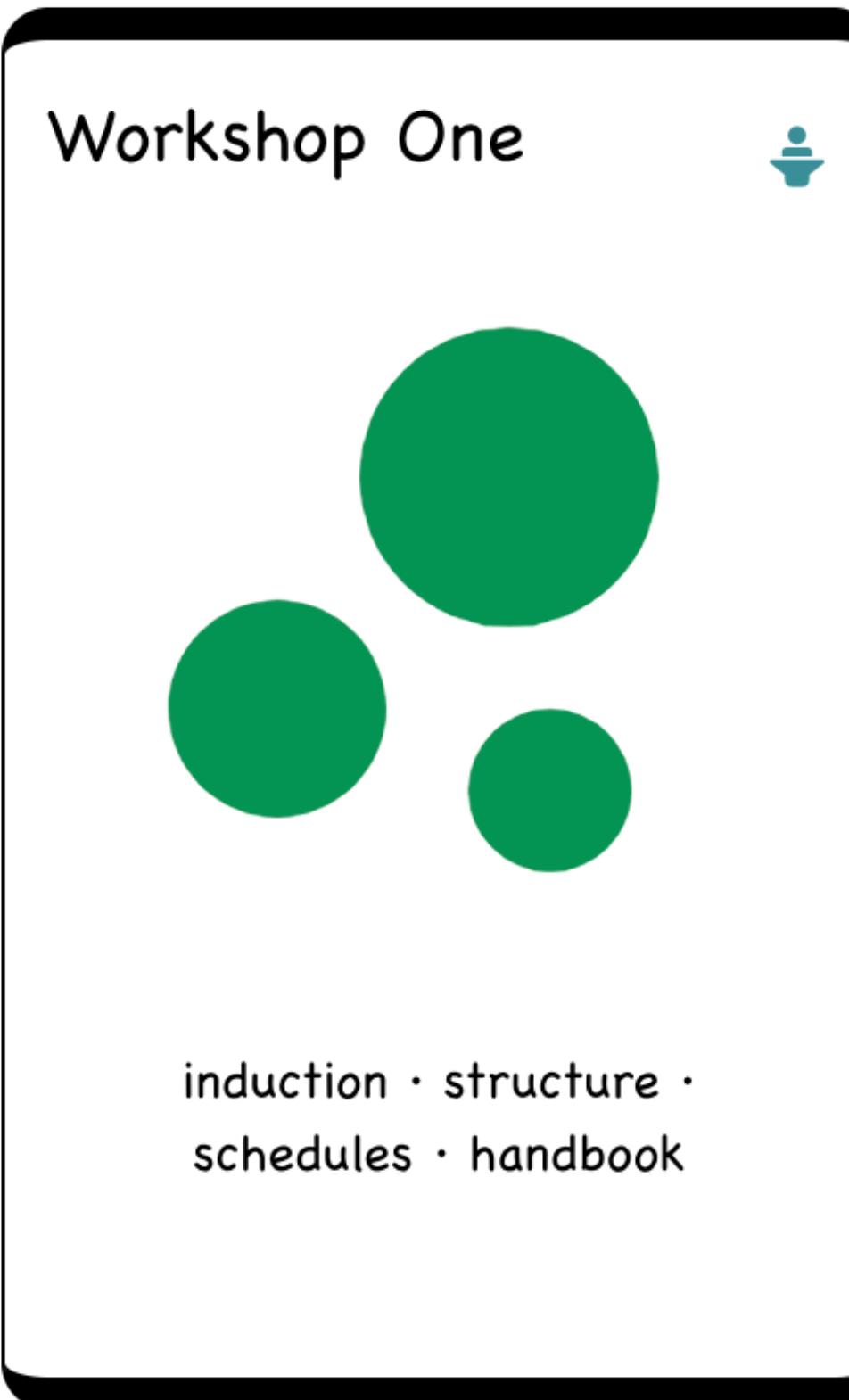
June 2024 - May 2025



## Project/Work Placement

(Work Placement 4-6 months)

Semester 1: January - June 2023



*“..a broad immersive set of modules in the fundamentals of computing covering **software development, systems analysis & testing, databases, architecture, OS & networking, web design / user-experience..”***

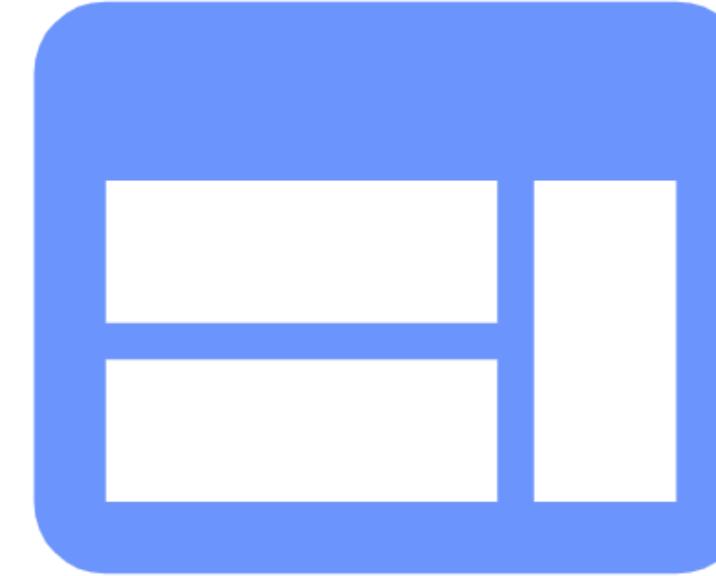
Semester 1: June - December 2023

Workshop Two



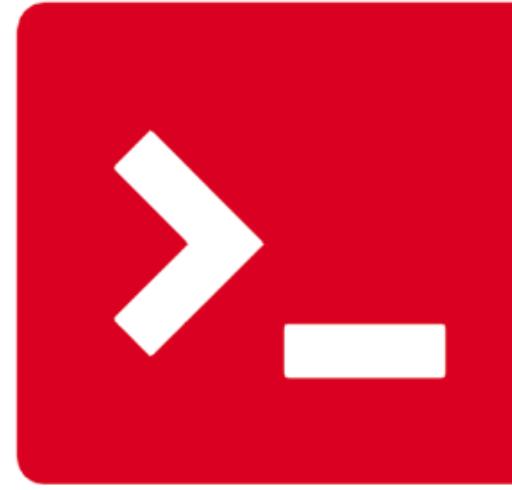
student perspectives ·  
project & placement ·  
introducing semester 2

Web Development 2



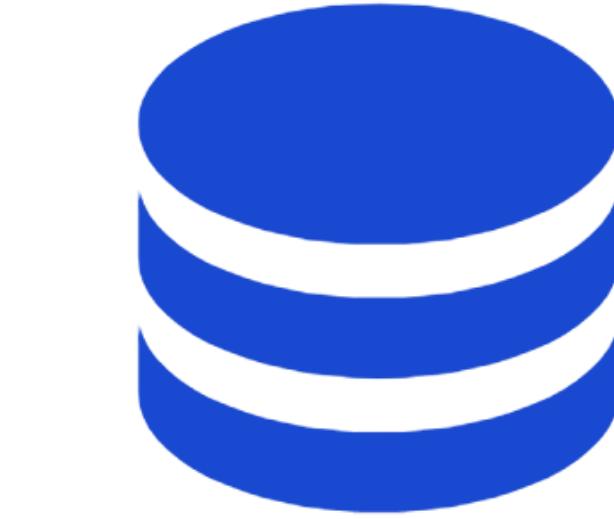
javascript · node · express  
· git · github · glitch

Computer Systems &  
Networks



logic · computer  
organisation · os ·  
networks · interfaces ...

Databases

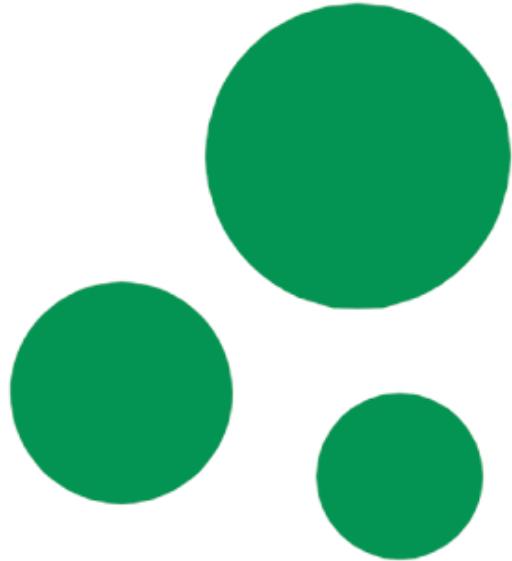


entities · tables · rows ·  
sql · er · nosql

*“..a broad immersive set of modules in the **fundamentals of computing** covering software development, systems analysis & testing, **databases, architecture, OS & networking**, web design / user-experience..”*

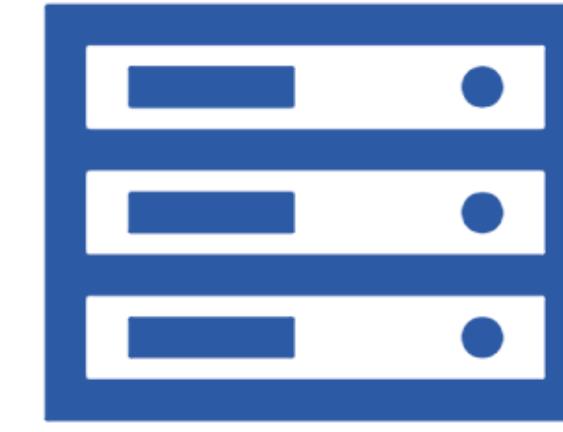
Semester 3: January - June 2024

Workshop Three



agile methods · cv preparation · introducing semester 3

Full Stack Development 1



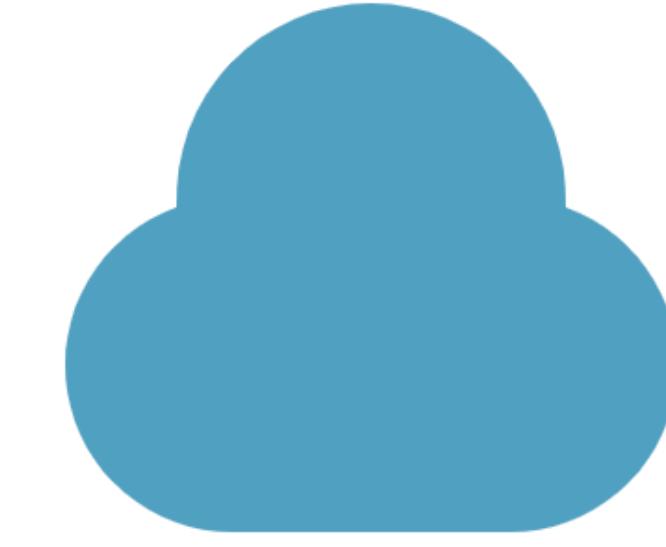
javascript · node · apis · tdd · frameworks · front-end · svelte

Software Security



security · crypto · threats · vulnerabilities

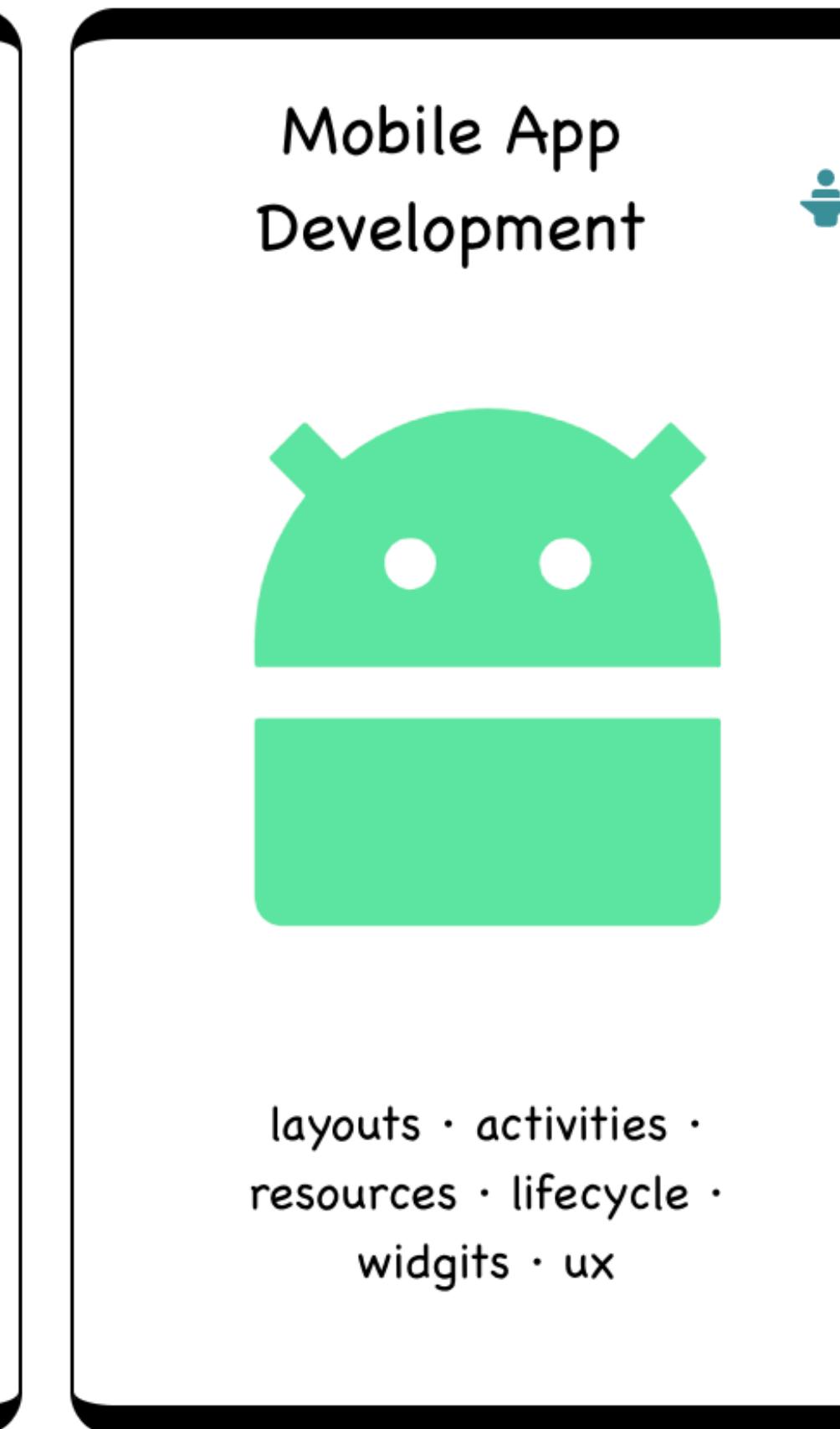
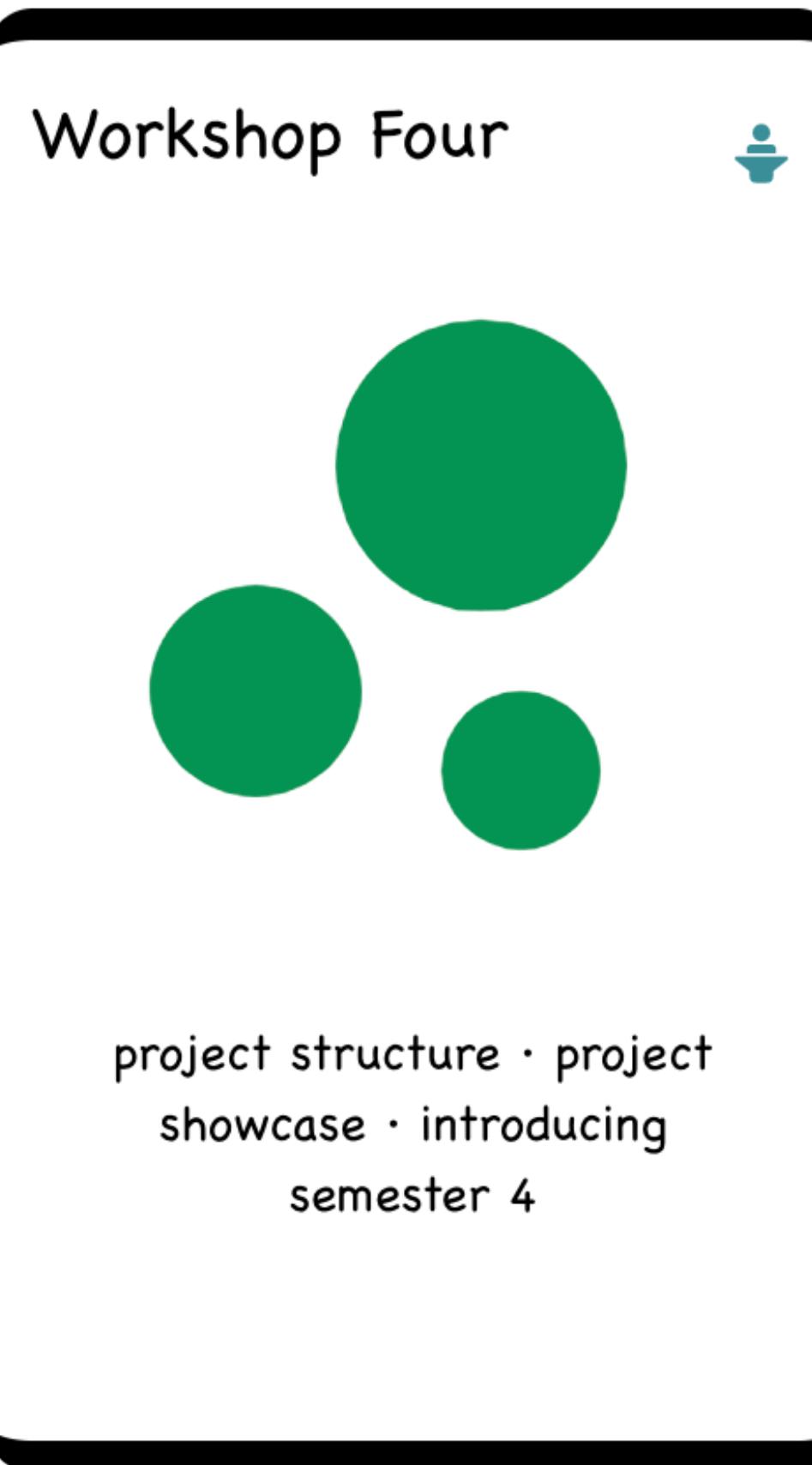
Developer Operations



cloud computing · scripting · scaling · automation · monitoring

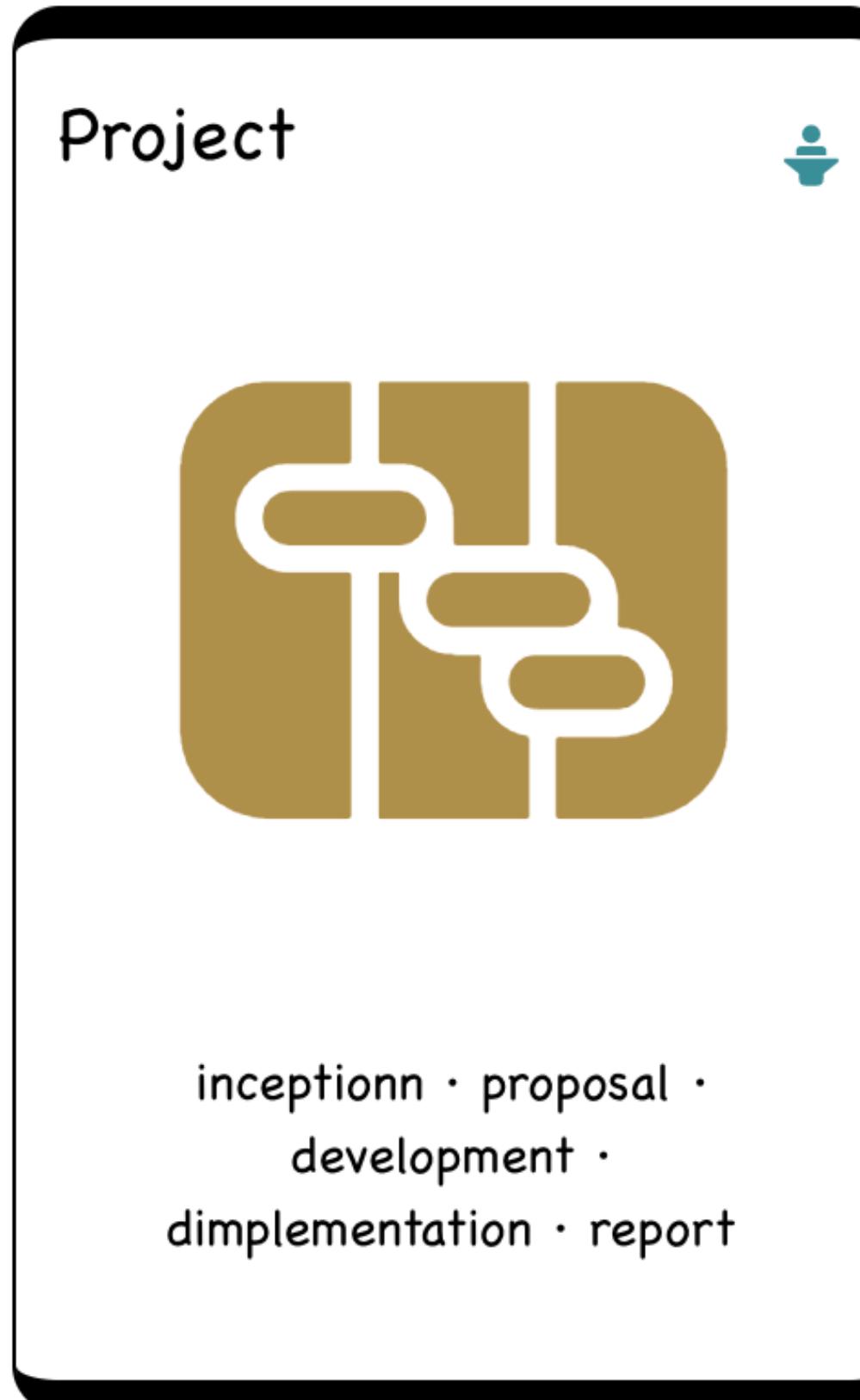
*“... students are expected to take a specialisation which reflects their own strengths as demonstrated on the programme to date...”*

Semester 4: June - December 2024



*“... students are expected to take a specialisation which reflects their own strengths as demonstrated on the programme to date...”*

Semester 4: September 2022 - May 2023



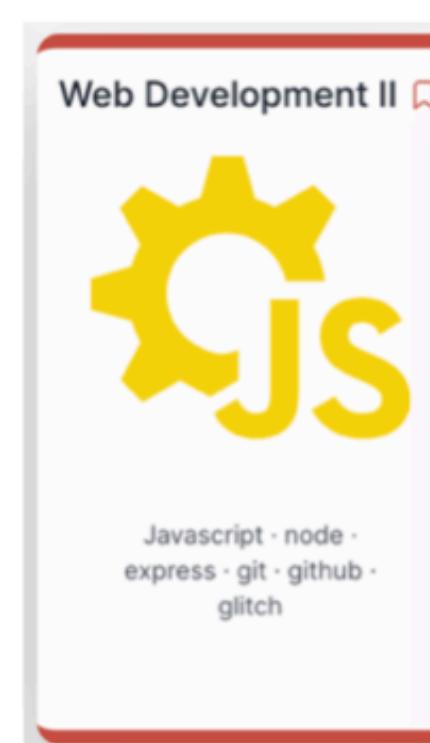
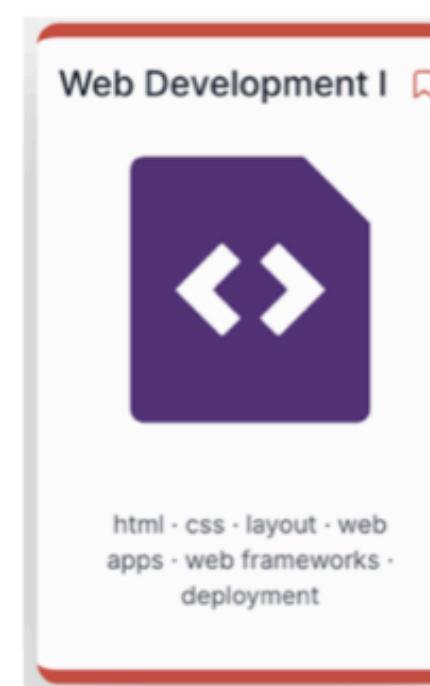
*“Internships or work placements are seen as crucial to providing graduates with the context and confidence in their new knowledge...”*

## 4. Calendar, Timetable & Assessment Sequencing

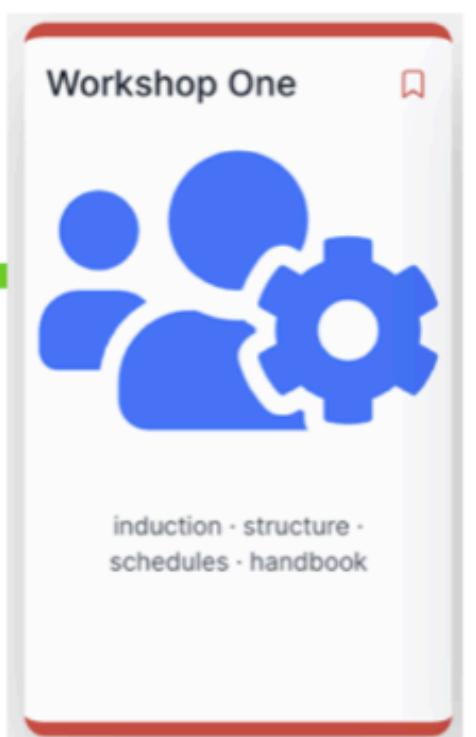


# Semester 1

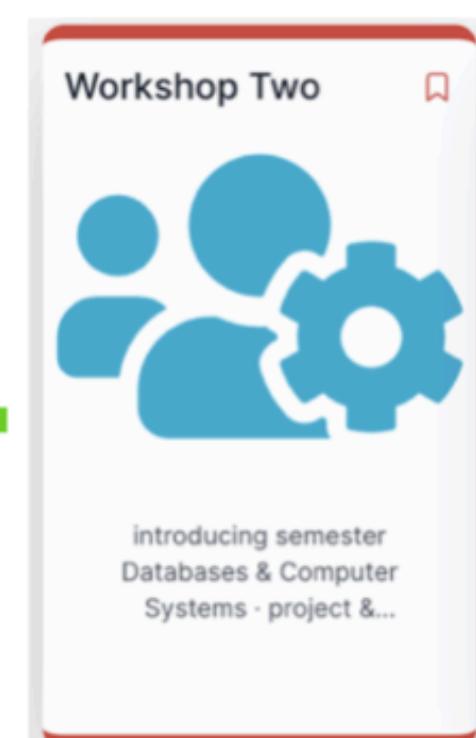
2023



|                 | S               | M  | T  | W  | T  | F  | S  |
|-----------------|-----------------|----|----|----|----|----|----|
| Week            | 1               | 2  | 3  | 4  | 5  | 6  | 7  |
| <b>January</b>  | 8               | 9  | 10 | 11 | 12 | 13 | 14 |
| 1               | 15              | 16 | 17 | 18 | 19 | 20 | 21 |
| 2               | 22              | 23 | 24 | 25 | 26 | 27 | 28 |
| 3               | 29              | 30 | 31 | 1  | 2  | 3  | 4  |
| <b>February</b> | reading         | 5  | 6  | 7  | 8  | 9  | 10 |
| 4               | 12              | 13 | 14 | 15 | 16 | 17 | 18 |
| 5               | 19              | 20 | 21 | 22 | 23 | 24 | 25 |
| 6               | 26              | 27 | 28 | 1  | 2  | 3  | 4  |
| <b>March</b>    | reading         | 5  | 6  | 7  | 8  | 9  | 10 |
| 7               | 12              | 13 | 14 | 15 | 16 | 17 | 18 |
| 8               | 19              | 20 | 21 | 22 | 23 | 24 | 25 |
| 9               | 26              | 27 | 28 | 28 | 30 | 31 | 1  |
| <b>April</b>    | <i>Easter 1</i> | 2  | 3  | 4  | 5  | 6  | 7  |
|                 | <i>Easter 2</i> | 9  | 10 | 11 | 12 | 13 | 14 |
|                 | 10              | 16 | 17 | 18 | 19 | 20 | 21 |
|                 | 11              | 23 | 24 | 25 | 26 | 27 | 28 |
| <b>May</b>      | 12              | 30 | 1  | 2  | 3  | 4  | 5  |
|                 | 7               | 8  | 9  | 10 | 11 | 12 | 13 |
|                 | 14              | 15 | 16 | 17 | 18 | 19 | 20 |
|                 | 13              | 21 | 22 | 23 | 24 | 25 | 26 |
|                 | 14              | 28 | 29 | 30 | 31 | 1  | 2  |
| <b>June</b>     | 14              | 4  | 5  | 6  | 7  | 8  | 9  |
|                 | 16              | 11 | 12 | 13 | 14 | 15 | 16 |
|                 | 17              | 18 | †  | 20 | 21 | 22 | 23 |
|                 | 25              | 26 | 27 | 28 | 29 | 30 | 1  |
| <b>July</b>     | 2               | 3  | 4  | 5  | 6  | 7  | 8  |



Thursday  
Jan 12

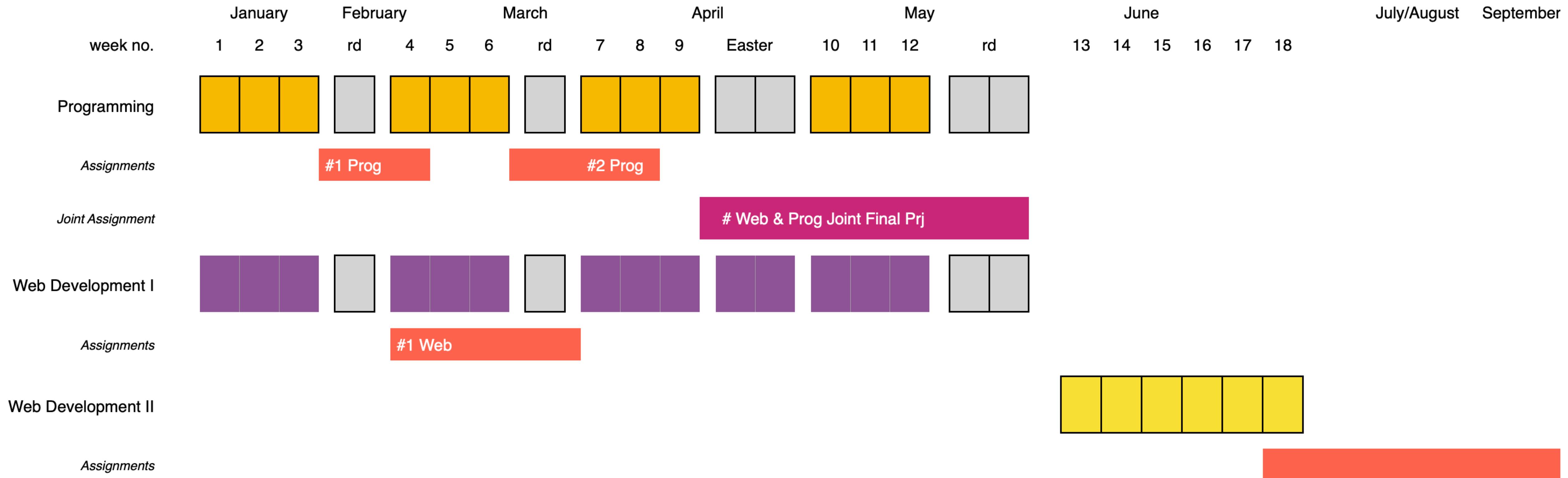


Thursday/Friday  
June 8/9

# Weekly Webinar Schedule

| MONDAY   | TUESDAY | WEDNESDAY  | THURSDAY   | FRIDAY |
|--|---------|--|--|--------|
| 10:45  |         |  |  | 10:45  |
| 12:15<br><br>Programming<br><i>Webinar</i><br>12:15-2:00 |         | 12:15<br><br>Programming<br><i>Webinar</i><br>12:15-2:00 | 12:15<br><br>Web Development<br><i>Webinar</i><br>12:15-2:00 | 12:15  |
| 2:00   |         |  |  | 13:45  |
| 15:15  |         |  |  | 15:15  |

# Semester 1 Assessment Schedule



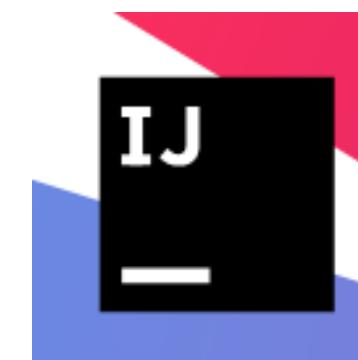
## 4. Module Summaries

# Programming



algorithms • data  
structures • processing •  
java • classes • libraries

- Apply core problem solving approaches suitable to the programming discipline to build algorithms.
- Construct small applications using standard sequence, conditional and iterative control structures. Change and expand small applications.
- Construct small applications that use simple UI, computation and data structures.
- Apply techniques to effectively test, debug and document small applications.
- Defend and explain how the above applications work.
- Apply problem-solving strategies to various computing problems of increasing complexity.
- Plan, code, test and document applications using advanced programming constructs and data structures



# Web Development 1

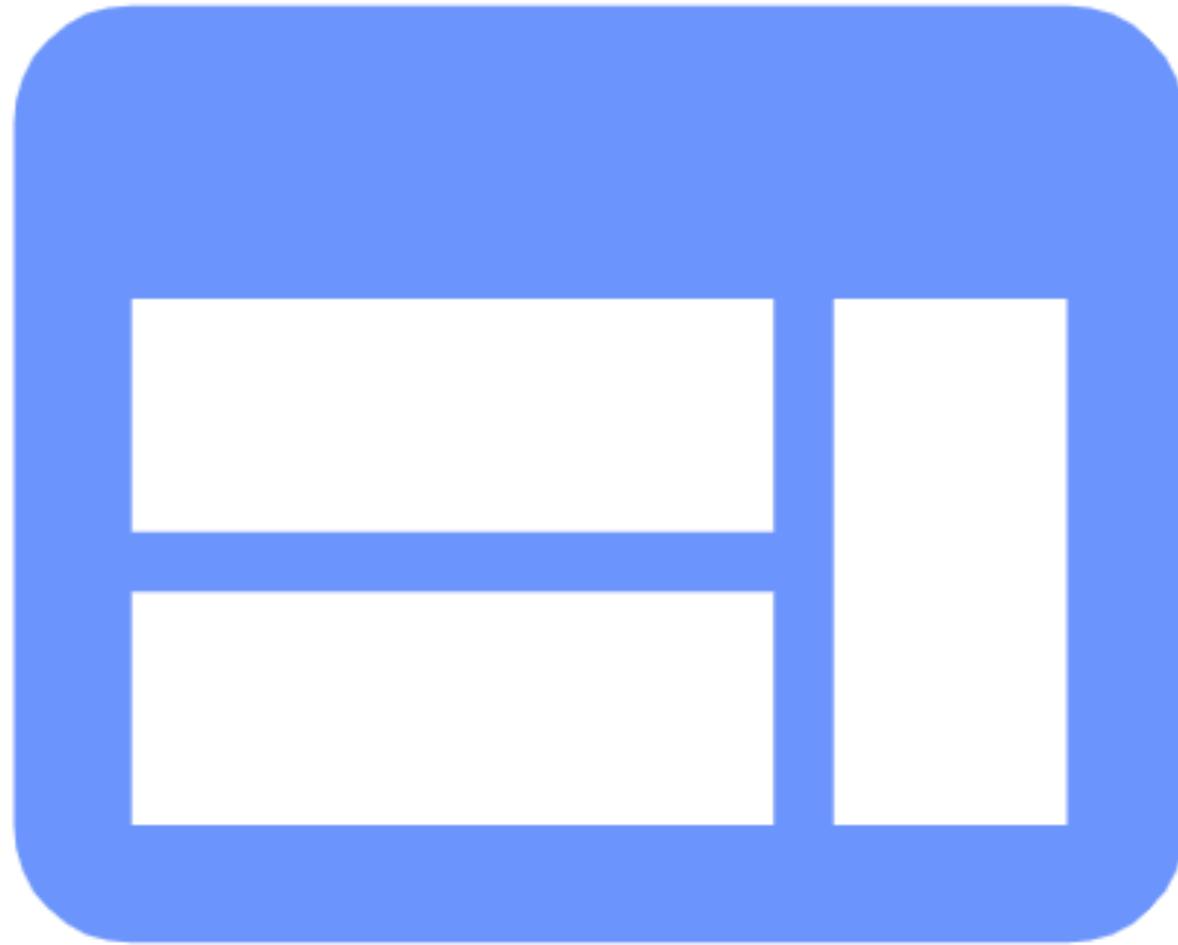


html · css · layout · web  
apps · web frameworks ·  
deployment

- Understand the fundamentals of the HTML markup language.
- Understand the role of Human Computer Interaction and manipulate CSS to present HTML content.
- Be able to integrate HTML, CSS and Java script to structure simple web sites.
- Understand how a dynamic web page is generated and be familiar with the role of html templating techniques
- Understand the difference between a web site and a web app. Be able to design and implement a simple web app.
- Implement a simple Model View Controller application pattern for a web app.

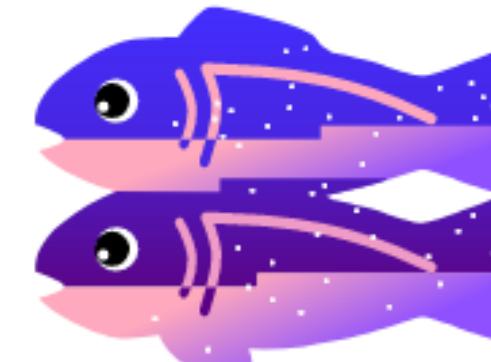


# Web Development 2



javascript · node · express  
· git · github · glitch

- Continue the journey into web application development
- Establish a competence in Javascript programming language
- Explore the basics of the Node.js framework
- Use a simple JSON persistent storage database
- Design, build and deploy a complete web application using these tools
- Understand the role of Agile methods in this context

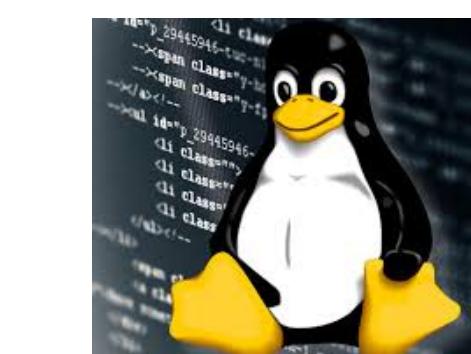
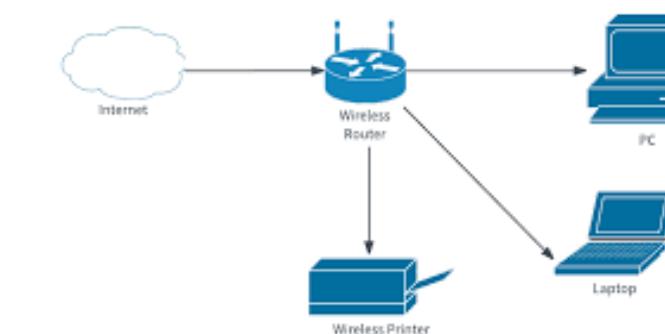


# Computer Systems & Networks



logic • computer  
organisation • os •  
networks • interfaces •...

- Identify and explain the role various hardware components play in a computer system.
  - Use an operating system on a chosen computer architecture.
  - Demonstrate an ability to configure systems using the command line.
  - Describe the memory management, process management and file management components of a modern operating system.
  - Explain basic concepts and theory of networked operating systems and virtualisation.
  - Configure a contemporary operating system (within a virtual machine environment)
  - Demonstrate competency in a limited set of utilities provided by a contemporary operating system.



# Databases



entities · tables · rows ·  
sql · er · nosql

MySQL™

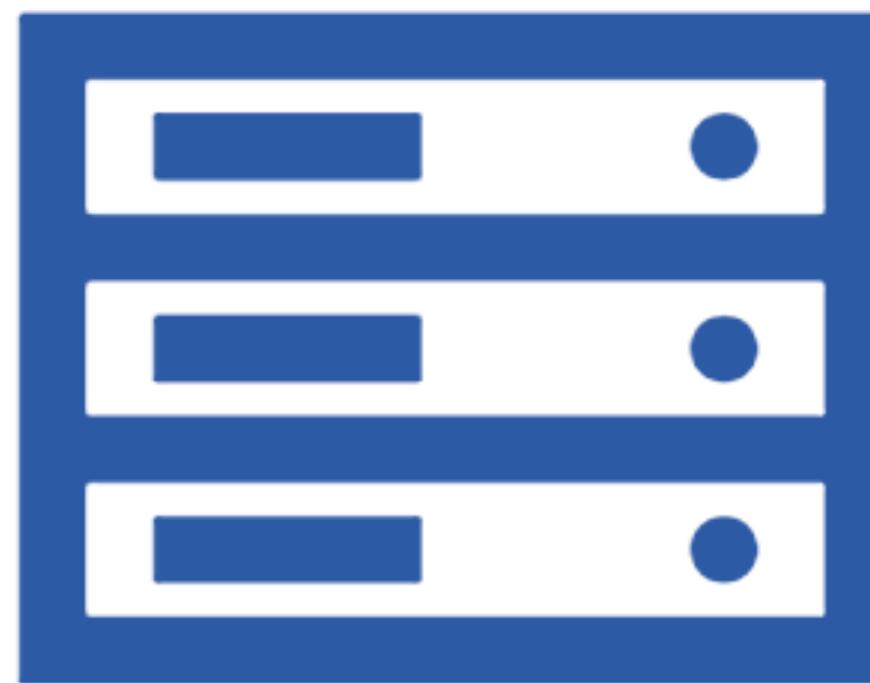
- Discuss the role of a database and its management system.
- Draw Entity Relationship (ER) diagram from an application problem and reproduce this diagram into a set of normalised relations, which are ready for database implementation.
- Design a NoSQL database suitable for a distributed environment with consideration of the CAP theorem.
- Gain an understanding of the physical database design process, its objectives and deliverables.
- Design and implement a database system



ORACLE®

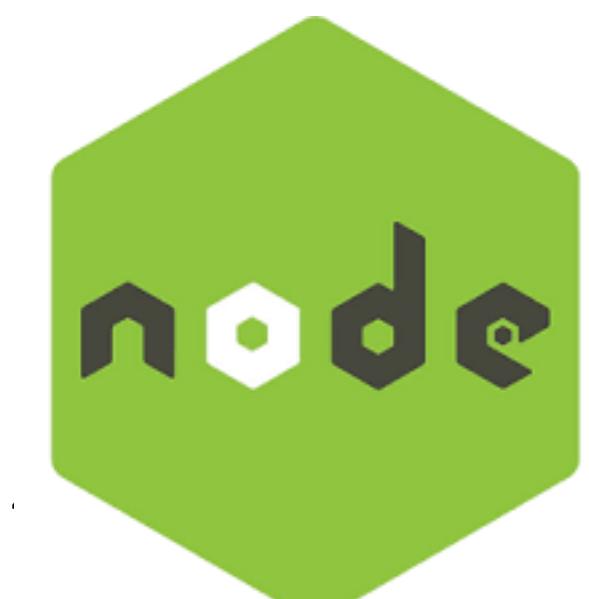
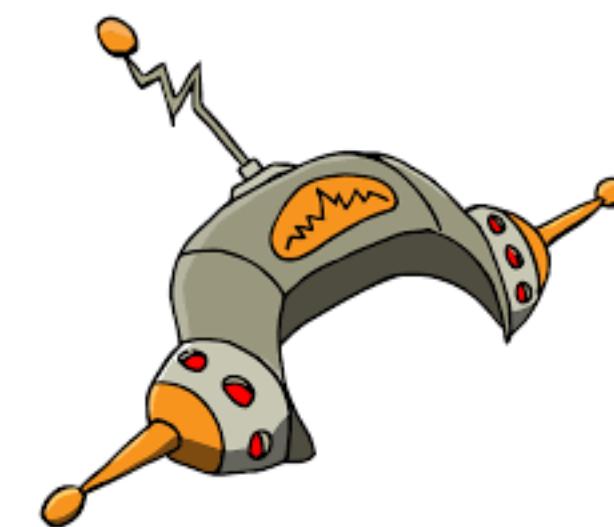
 mongoDB®

# Full Stack Development 1



javascript · node · apis ·  
tdd · frameworks · front-  
end · svelte

- Examine the key components of a server rendered web application and incorporate them into a running application.
- Use Model View Controller & related patterns in the implementation of a web project.
- Relate the request/response lifecycle, routing & session management in the context of a modern application framework.
- Model the user requirements and realize the model in a simple database.
- Apply best practice principles and patterns to the design and documentation of a web API.
- Apply best practice principles and patterns to the design of a medium-sized Single Page Web App.
- Develop an end-to-end web app that supports session management and persistence for a constrained functional requirement set.



# Software Security



security · crypto · threats  
· vulnerabilities



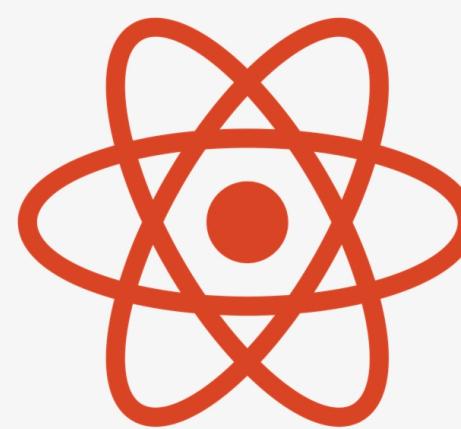
- Demonstrate specific security problems that can arise with web applications and how to address them.
- Compare and contrast alternative approaches to authentication in both enterprise and consumer-oriented web applications.
- Use a selection of best security practices in a web application.

# Full Stack Development 2



SPA · react · APIs · front-  
end

- Introduce React + Storybook
- Explore the React component model
- Understand component navigation, lifecycle & routing
- Review the react methodology
- Select appropriate state management strategies & components

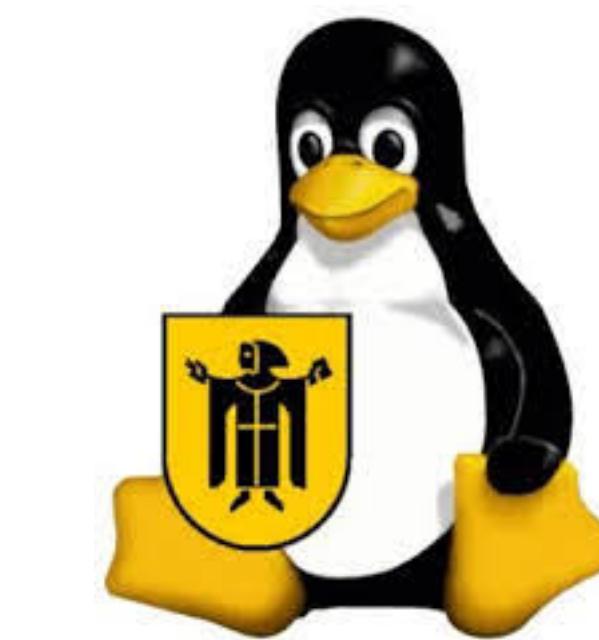


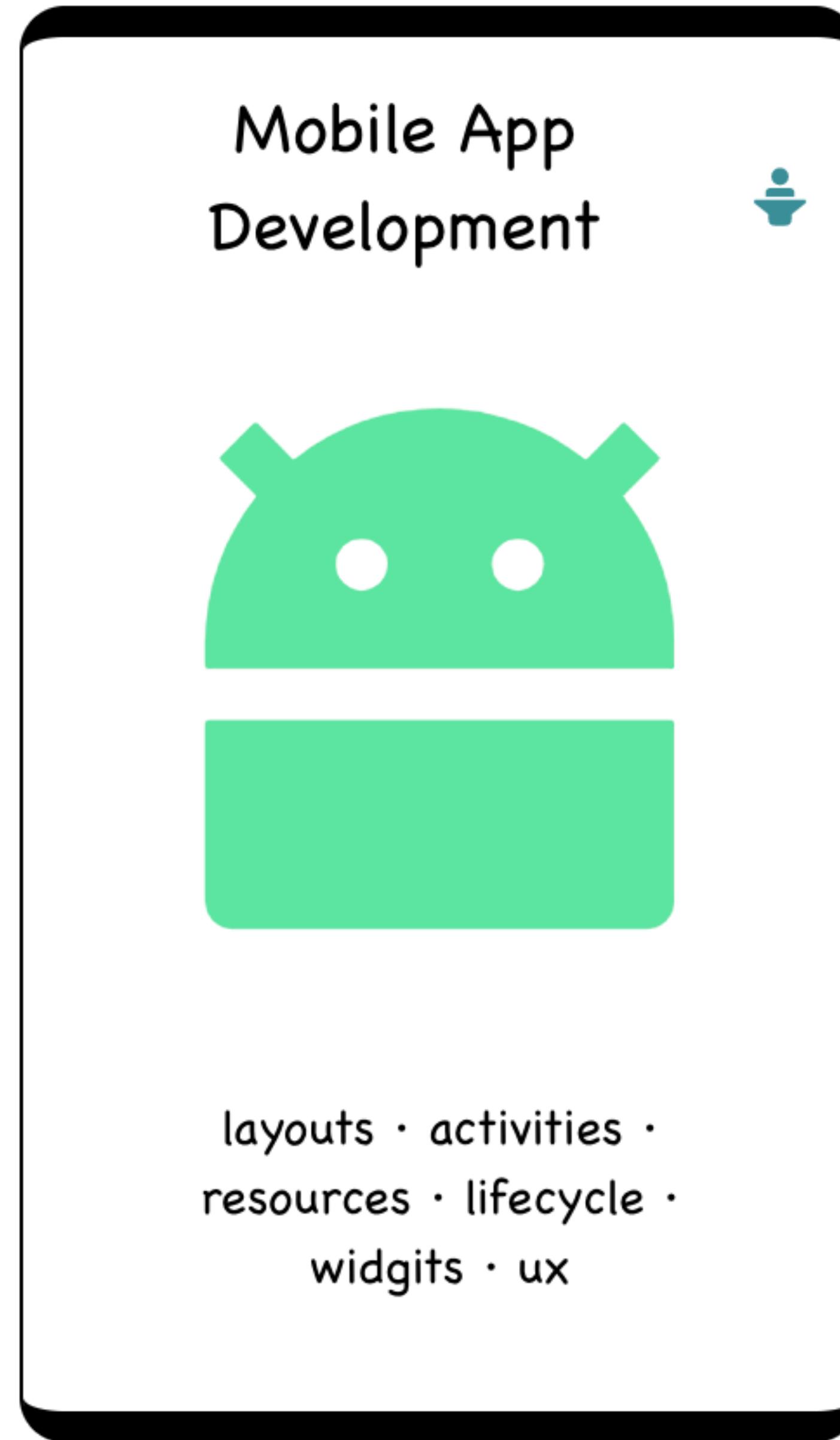
## Developer Operations



cloud computing · scripting  
· scaling · automation ·  
monitoring

- Build, configure and manage essential network infrastructure services.
- Build, configure and manage essential application services.
- Deploy a network monitoring solution.
- Develop scripts to assist in the management and automation of modern network services.
- Configure appropriate security mechanisms, including firewall rules, encrypted services, and authentication.





- Decompose an application into its constituent parts, including but not limited to: core application components, user experience resources, packaging.
- Design a coherent User Experience - using appropriate tools, practices and guidelines - for a moderately sized application. Produce a medium sized application, based on a limited set of design patterns.
- Manage the application lifecycle. Structure persistent storage on a device and reliably save and restore application state.
- Select the appropriate design patterns and tools in the development of complex mobile apps.
- Comment on the chosen mobile app framework and the underlying hardware components.
- Design and develop complex multi-screen mobile apps from concept through to completion using best practices and guidelines.
- Set up the interaction of an application with internal sensors and physical subsystems.
- Integrate a remote service API within an application, perhaps based on REST principles, to deliver aspects of its core features set.



# Opportunities for Further Study

- The development team are closely involved in the delivery of two potential follow-on graduate programmes:
  - MSc in Enterprise Software Systems
- These are mature courses, closely aligned with research at TSSG, with substantial enrolments in part-time mode from industry practitioners in the region.
- Successful candidates could continue their academic development in part-time or full-time capacity.



