

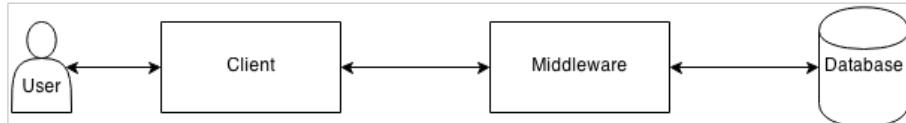
THREE TO N TIER ARCHITECTURES

Further Tiered Architectures

- An improvement is to separate the application into **three (or N-) tiers**:
 - **presentation** processes deal exclusively with the user interface – this might, for instance, be through the use of a browser or other user agent
 - **application** processes deal with the logic of the application, queries, calculations, etc. – there is either one (3-tier) or more (N-tier) of such processes
 - **data source** processes supply the data from a database (binary) or a file (for instance, XML)

Three Tier Architecture

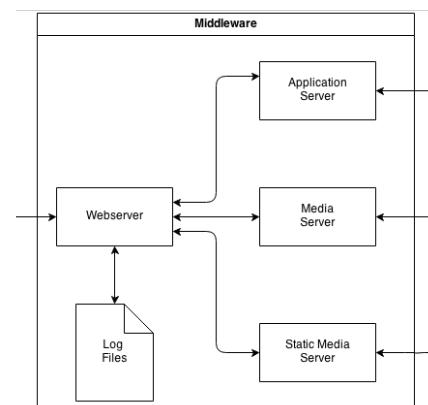
- **Basic Three Tier Architecture:** where the client handles the interaction with the user, the middleware handles the application logic, and the database stores the data



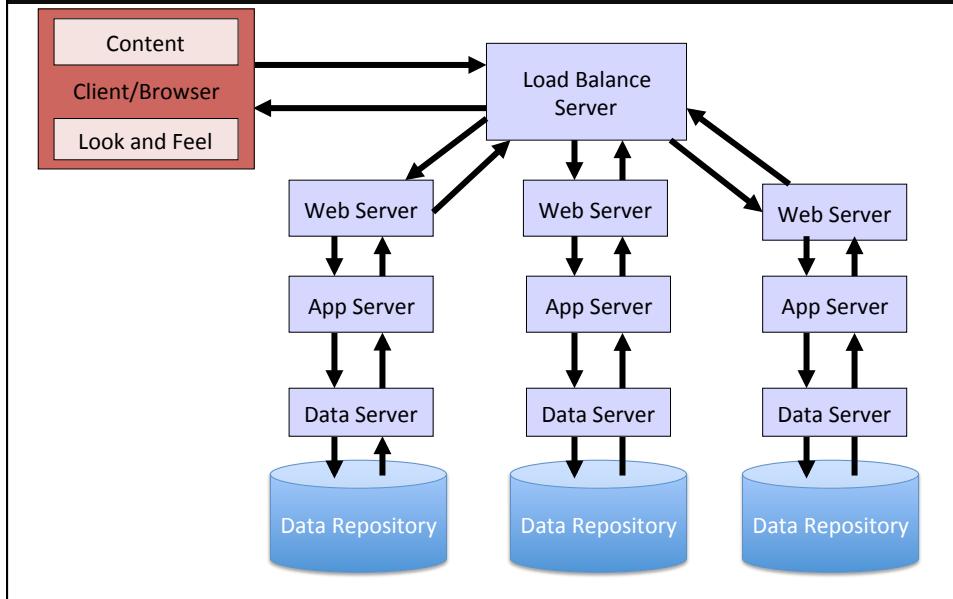
- **Database:** persists and manages the data associated with the application
- **Separation of Concerns:** This architecture further separates out responsibilities (presentation, logic, data)

Middleware (Zoom in)

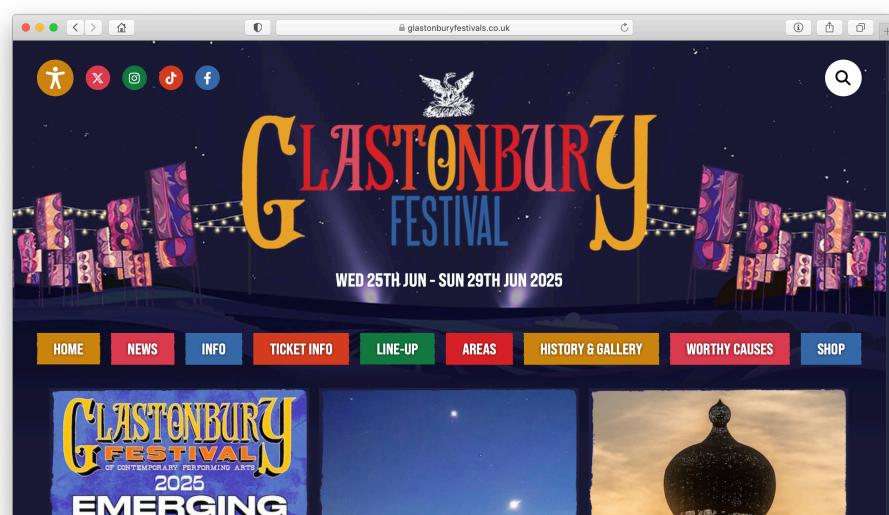
- Within the middleware tier, usually there is a webserver, an application server, and potential media servers
- **Webserver:** handles incoming requests, directing them to the appropriate server
- Servers could be on the same machine or different machines



N-Tier Architecture



Load Balancing



Load Balancing

- There are two main ways to balance the load
 - Using a **Domain Name Server** such that when a URL is resolved, it rotates through a series of IP addresses that route the message to that machine.
 - Using a **Load Balancing Server**, which farms out the requests to available machines.
 - Machines in the farm inform the LBServer of their load so that the load can be balanced.



SUMMARY

Tiered Architecture Benefits

- Tiers enable the separation of concerns
- Tiers encapsulate complexity
 - they can be broken down into layers or into sub-tiers
- Tiers can be distributed across a number of machines
 - Providing flexibility
 - Providing more security (as clients do not interact directly with the database)
- Tiers can be replicated across a number of machines
 - Providing scalability

System Architecture Diagrams

Top Down Design

- Starting from a **high level design** is useful because:
 - it helps describe the system at a level which makes the **goals, scope and responsibilities** clear
 - the abstraction provides a tool for communicating the design
 - permits the specific technologies to be **chosen late** or to be **changed**
 - **maintenance** and **re-usability** also profit

Bottom Up Design

- Piecing together components to give rise to more complex systems, thus making the original elements sub-systems of the emergent system
- The most specific and basic individual components of the system are first developed
- These elements are then linked together to form larger subsystems, which then in turn are linked, sometimes in many levels, until a complete top-level system is formed
- This strategy often resembles a "seed" model, by which the beginnings are small but eventually grow in complexity and completeness
- What are the advantages and disadvantages?

Top-Down vs. Bottom Up

Separates the low level work from the higher level abstractions		Coding begins early and so Testing can be performed early
Leads to a modular design		Requires really good intuitions to determine functionality of modules
Development can be self-contained (tiered)		Low level design decisions can have major impact on solutions
Emphasizes planning and system understanding		Risks integration problems – how do components link together
Coding is late, and Testing is even later		Often used to add new module to existing system
Skeleton code can show how everything integrates		

Diagram and Design

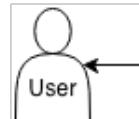
- Architects need to communicate to developers how the application and its components fit together and who is responsible for what
- The designs also serve as a communication tool with the client
- It is important to be able to draw and read such diagrams especially when projects become large and complex

Notation for System Architecture

- **Modified Dataflow Language** where we have the following entities:
 - User
 - Client
 - Middleware
 - Database/Datastore
 - Logs/Files
 - External Service/Application
 - Communications/DataFlows

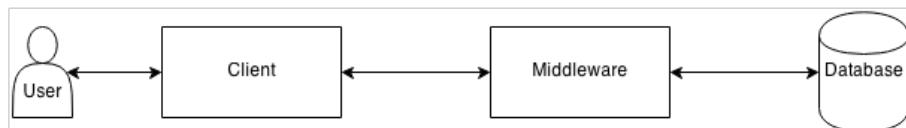
User

- The user or customer instigates and interacts with the services or applications provided
- There are various types of users including:
 - end users (of varying abilities)
 - administrators
 - developers
 - other systems
 - etc



Client

- The client and the interface presented takes on many forms and can vary greatly:
 - web browser on a PC, tablet, mobile, etc
 - an API for other systems, agents, developers, etc
 - devices and robots
 - sensors

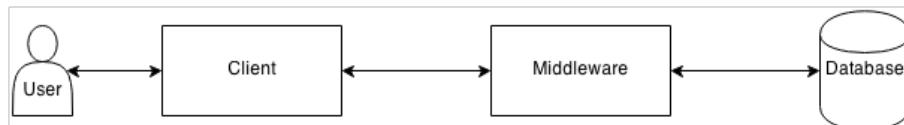


Middleware

- The middleware houses an array of possible components from:
 - Domain Name Servers
 - Load Balancing Servers
 - Web Servers
 - Application Servers
 - Caching Servers
- Typically the first three are predefined or configured using standard software
- The Application Server is what is mainly of interest, i.e., what needs to be developed.

Middleware

- Often represented as a single component that brokers requests between the client and database.
 - Though encapsulates a number of other components



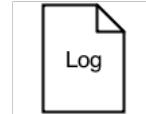
Databases

- A database server is usually employed to handle the data management side of applications.
 - i.e., Postgres, SQLServer, MySQL
- While the system is usually already in existence, it needs to be configured
 - i.e., the database tables have to be defined and populated
 - To specify this part more precisely ER Diagrams can be used



Logs and External Services

- Logs represent data sinks
 - The application outputs data but does not read it back, directly
- External Services represent applications and services that are used by the application
 - they provide an API or interface of some kind that can be used to interact with the service

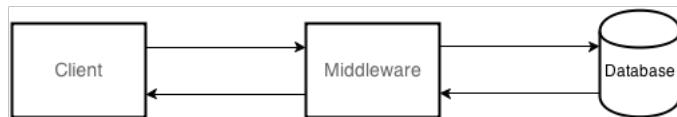


Technology and Devices

- For each box, we could choose to specify the technology/device used, e.g
 - Client: Web browser on a mobile device, using HTML/CSS/JS
 - Middleware: Apache Web Server, with an Application Server built using Django
 - Database: MySQL Database Server

Data flows

- Arrows are used to denote the flow of information
 - The direction of the arrow denotes the direction of the communication
 - Most communications are both ways, where a request is made, followed by a response
 - This shows how the entities are related



Information Architecture

Web Application Development 2

Types of Architecture

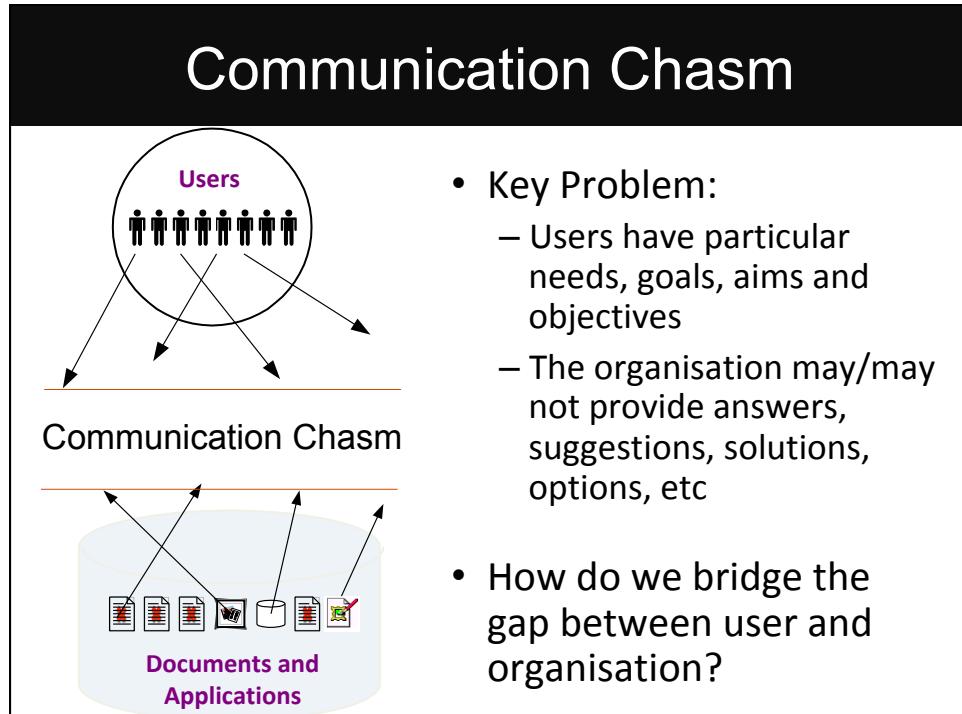
System Architecture

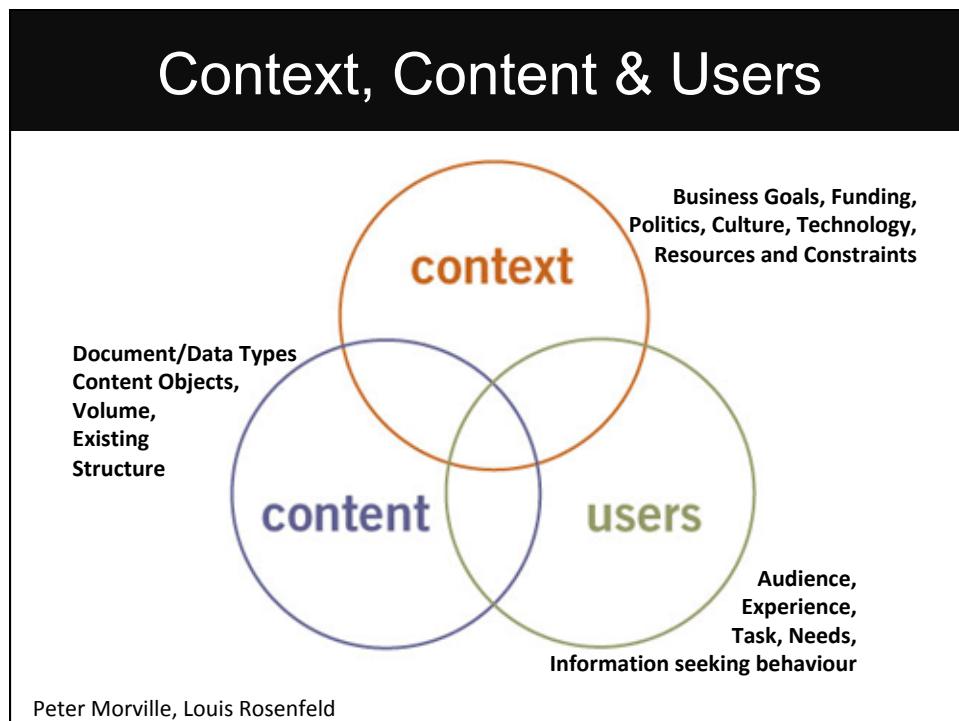
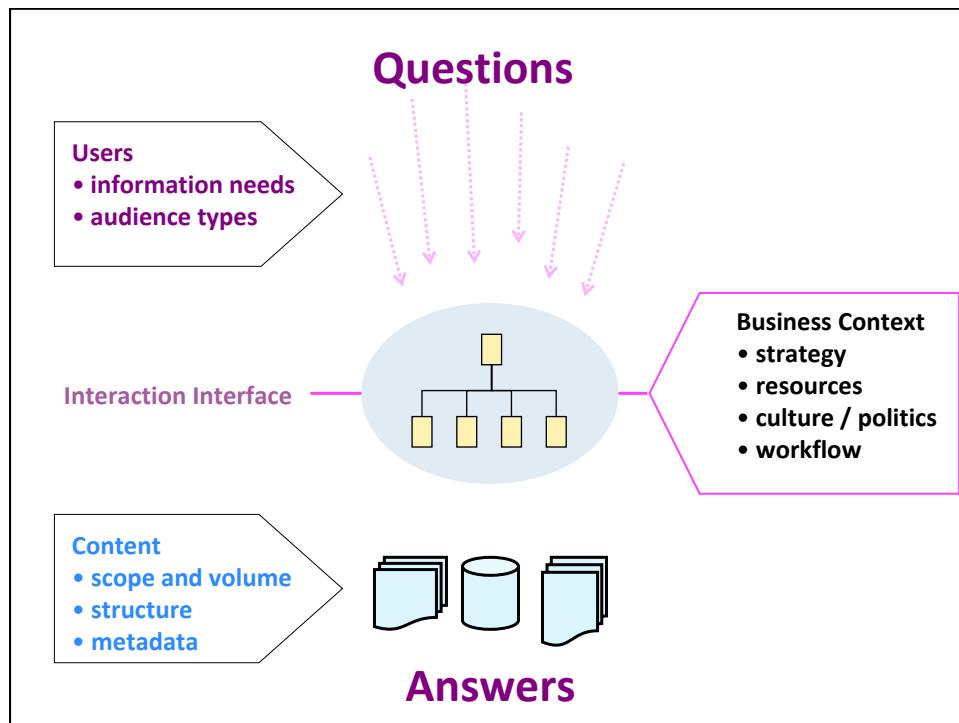
Information Architecture

Information Architecture

1. The **structural design of shared information environments**
2. The combination of **organisation, labelling, search** and **navigation systems** within web sites and intranets
3. The **art and science** of shaping information products and experiences to support **usability** and **findability**
4. An emerging discipline and community of practice, focused on bringing **principles of design and architecture** to the **digital landscape**

USER STAGES IN RECRUITMENT PROCESS FOR MEMP				
	THE POWERLESS PROSPECTIVE	THE APPLICANT	THE POWERFUL PROSPECTIVE	THE ENROLLED NEWBIE
What's in it for me?	<ul style="list-style-type: none"> Has decided school/university is a good option and is now looking program distinctions. We need to answer: How is Duke different? 	<ul style="list-style-type: none"> Has decided that Duke and engineering management are good decisions and wants to apply. 	<ul style="list-style-type: none"> Has been accepted to the program, and needs to decide whether to enroll. 	<ul style="list-style-type: none"> Has decided to enroll at Duke and has questions about moving to NC, career to take.
What's in it for society?	<ul style="list-style-type: none"> Another possible entry point if step one was completed at another site. We are likely to rely on Google hits from this user. 	<ul style="list-style-type: none"> Is concerned with student life, assumptions (cost), has lots of questions about logistics and qualifications 	<ul style="list-style-type: none"> Asking again "is Duke right for me?" but with the confidence that "I'm right for Duke." 	<ul style="list-style-type: none"> Is possibly interested in social implications. Might already be committed with Duke/Burnham.
What's in it for the future?	<ul style="list-style-type: none"> Asking about ROI and likely weighing reputation/cost/benefits each institution. 	<ul style="list-style-type: none"> Might want to visit either virtually or in person. 	<ul style="list-style-type: none"> Concerned with connections and collaboration with other universities. 	<ul style="list-style-type: none"> Strongly weighing ROI, industry ties, connections, reputation. Visiting 35 other institutions, some of which may not be top priority.
	thinking like a user			

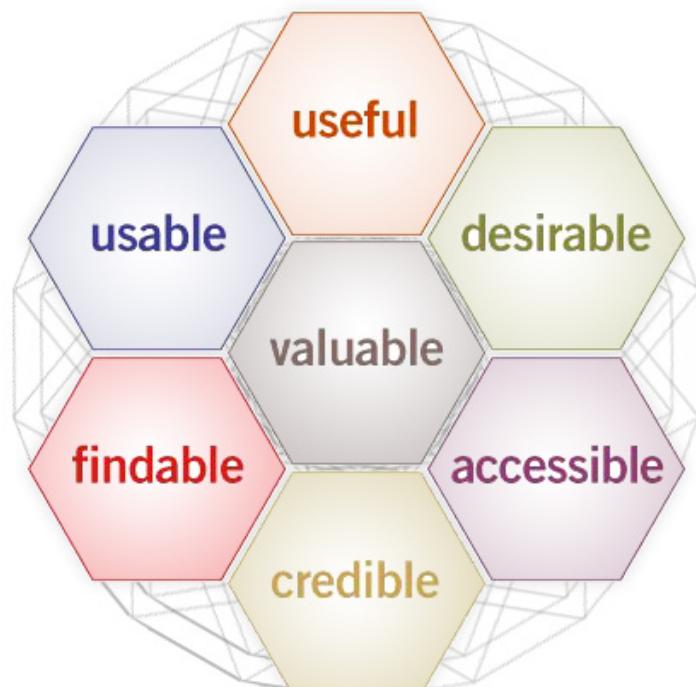




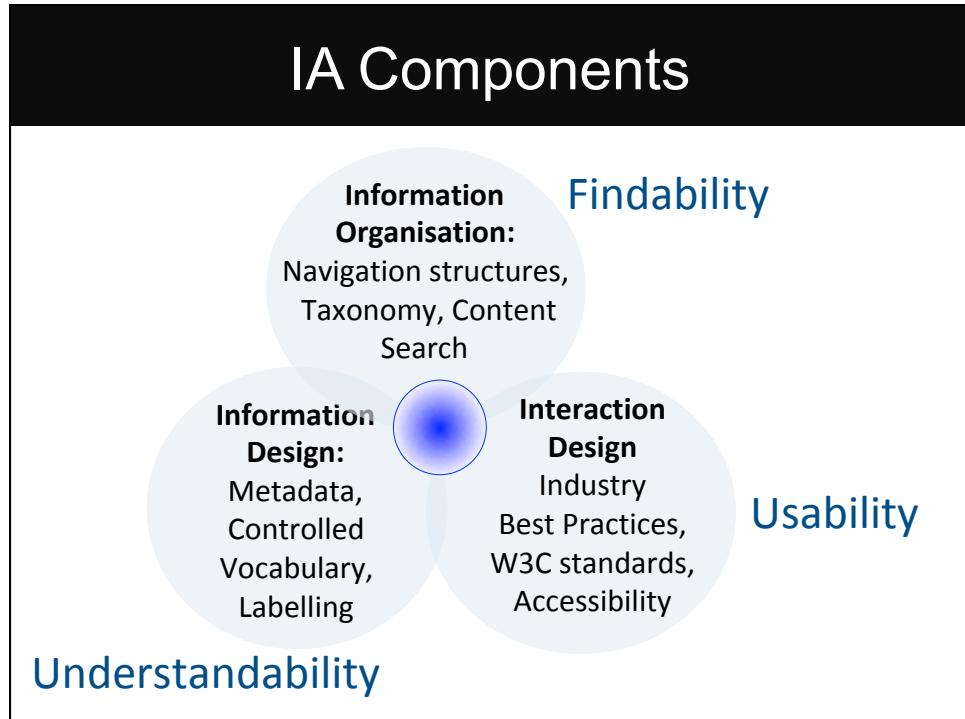
Why is IA Important?

- Cost of **finding**
 - time, frustration
- Cost of **not finding**
 - bad decisions, alternate channels
- Cost of **construction**
 - staff, technology, planning, bugs
- Cost of **maintenance**
 - content management, redesigns
- Cost of **training**
 - employees, turnover
- Value of **brand**
 - identity, reputation, trust

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IA Components



Top Down Design

- Top Down Design (from an Information Architect's Perspective) is designing for when a user arrives at the main page of the site
- Typical questions the users have in mind when they arrive are:
 - Where am I?
 - I know what I want, how do I search for it?
 - How do I get around this site?
 - What useful, important, unique about this site?
 - What's available, what's happening?
 - How can I get help, contact a human, get their address?

Bottom-Up Design

- Bottom Up Design is catering for when the user lands somewhere in your site
 - typically via a search engine
- Typical questions are:
 - Where am I?
 - What's here?
 - What else is here?
 - Where can I go from here?

Information Systems

- Information Retrieval Systems
 - Users query the search engine via the search interface
 - Results are ranked and returned
- Navigation Systems
 - Global Navigation
 - Local Navigation
 - Contextual Navigation

