

Software Architecture for Developers

@simonbrown

Five things every developer should
know about software architecture

**1. Software architecture isn't
about big design up front**

Historically there's been
a tendency towards
big design up front

“Waterfall”

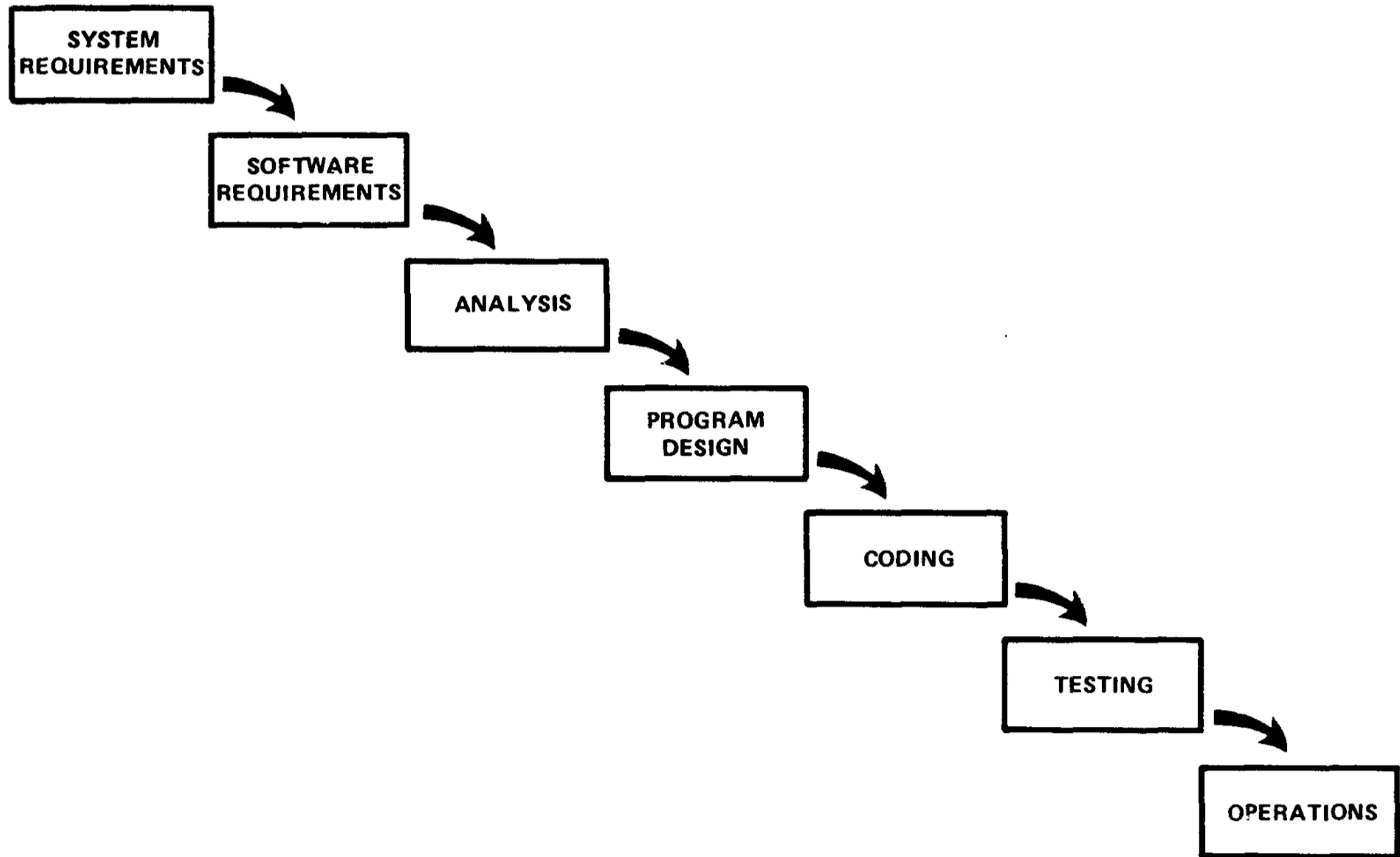




Figure 2. Implementation steps to develop a large computer program for delivery to a customer.

I believe in this concept, but the
implementation described above
is risky and invites failure.

Managing the development of large software systems

Dr Winston W. Royce



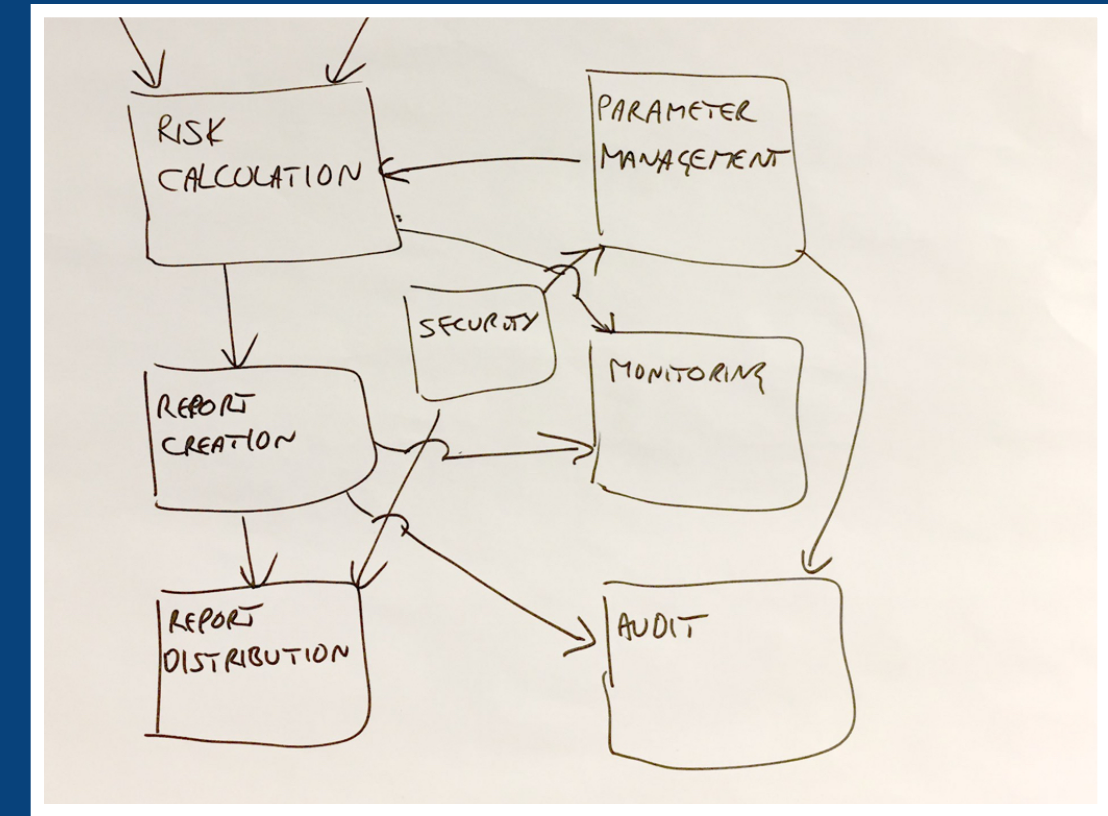
Responding to change
over
following a plan

Moving fast, embracing change,
delivering value early, getting feedback

VS

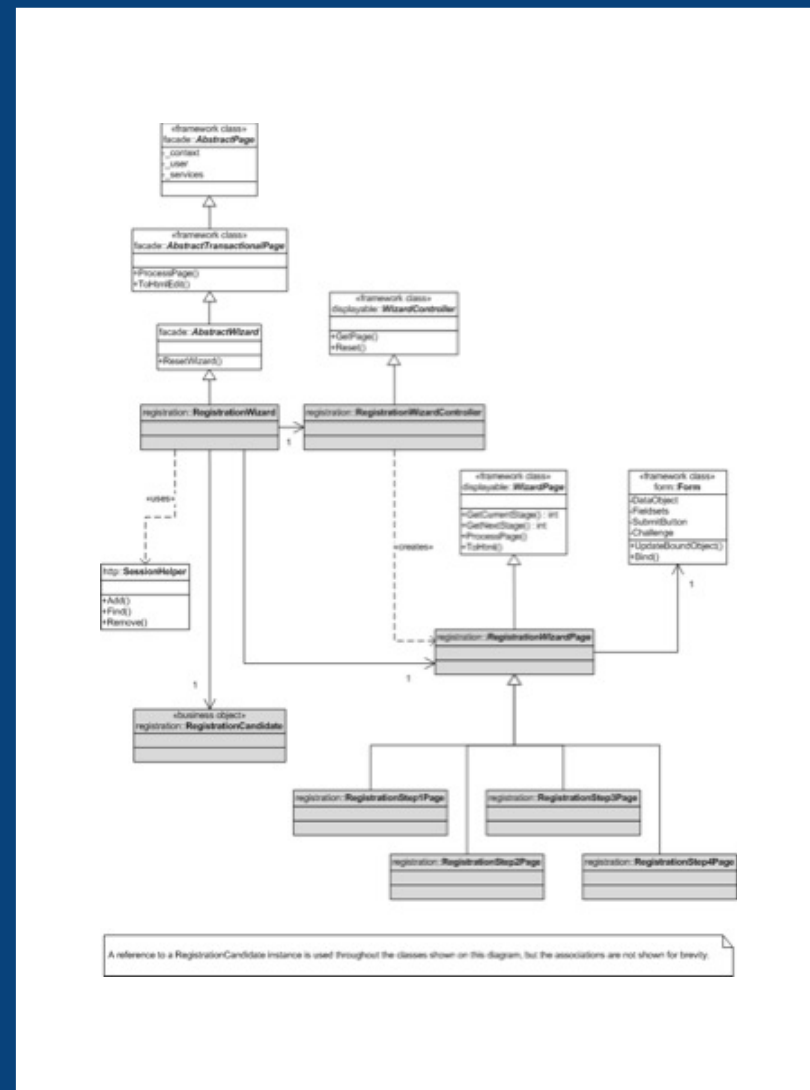
Understanding everything up front,
defining a blueprint for the team to “follow”

Big design up front



VS

Software Architecture Document



No design up front

Big design up front is dumb.
Doing no design up front
is even dumber.

Dave Thomas

How much **up front design** should you do?



The background features four slanted, semi-transparent blue bars. Two bars are on the left side, and two are on the right side, all slanted at the same angle.

just enough

It's not about creating a
perfect end-state or
complete architecture

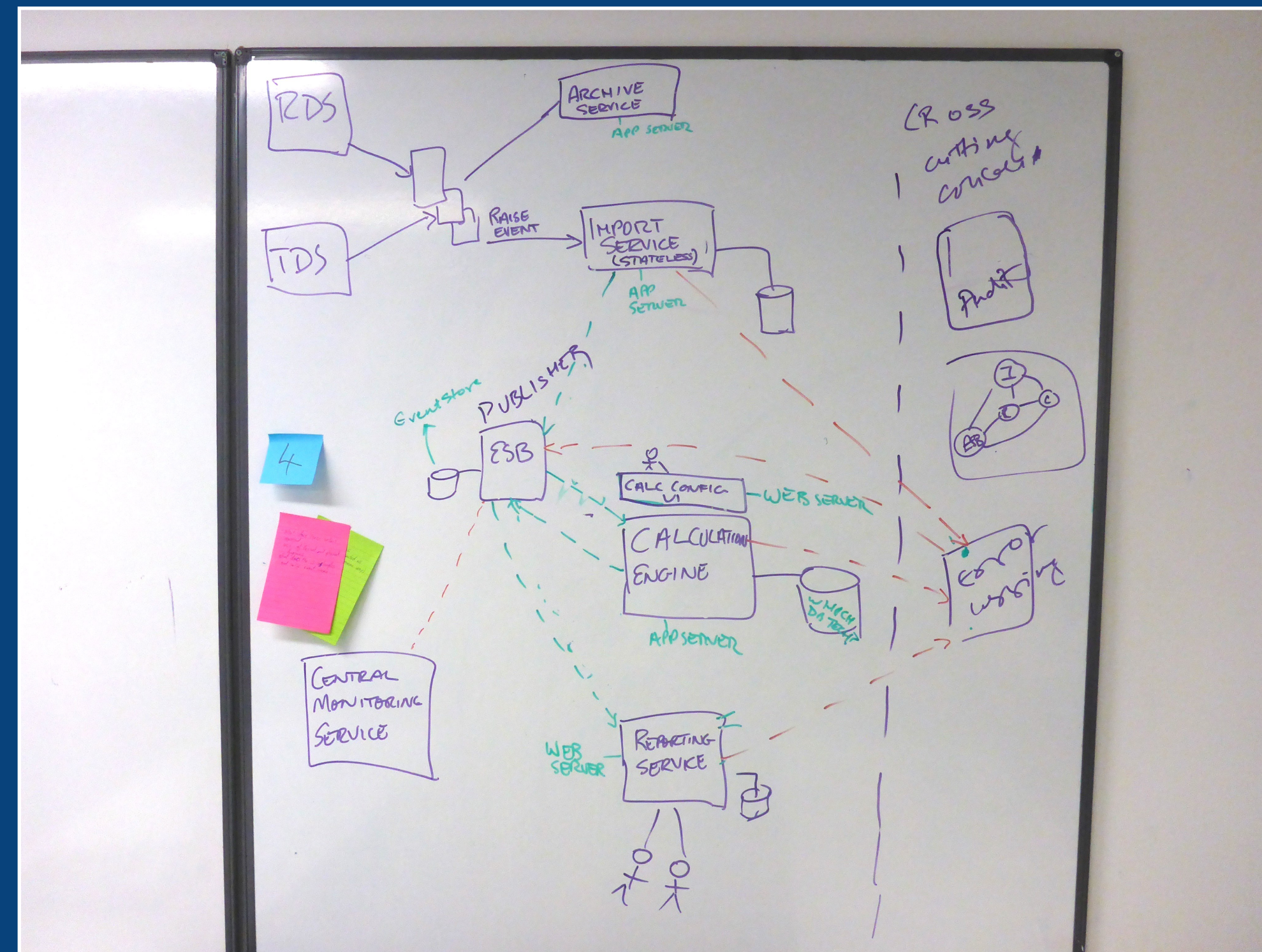
You need a
starting point



Evolutionary Design

Beginning With A Primitive Whole

1. Is that what we're going to **build**?



2. Is it going to **work**?

Architecture represents the
significant decisions, where significance
is measured by **cost of change**.

Grady Booch

Architecture

Programming language
Monolith, microservices or hybrid approach

Design

Implementation

Curly braces on the same or next line
Whitespace vs tabs



**Identify and mitigate
your highest priority risks**

Base your architecture on
requirements, travel light
and prove your architecture
with concrete experiments.

Agile Architecture: Strategies for Scaling Agile Development

Scott Ambler

Concrete experiment

Proof of concept, prototype, spike, tracer, vertical slice,
walking skeleton, executable reference architecture, ...

Just enough up front design to create
firm and sufficient foundations

Thinking about
software architecture lets you
stack the odds of success
in your favour

**2. Every software team needs
to consider software
architecture**

What happens if a software
development team **doesn't**
think about architecture?

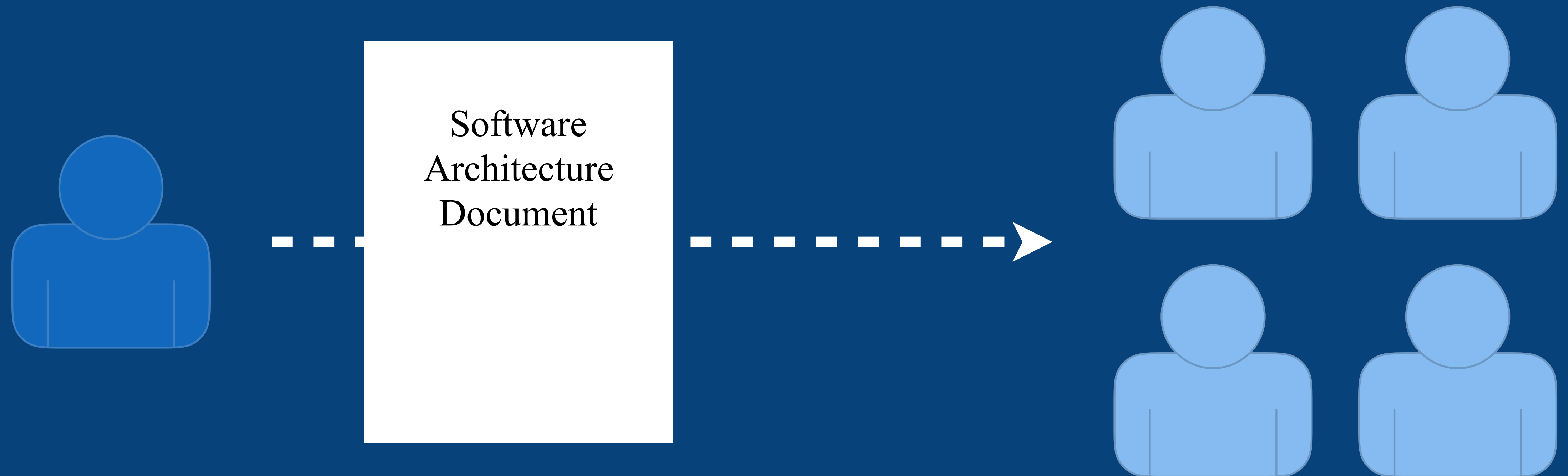
Chaos

Big ball of mud, spaghetti code, inconsistent approaches to solving the same problems, quality attributes are ignored, deployment problems, maintenance issues, etc

Every team needs
technical leadership

**3. The software architecture
role is about coding, coaching
and collaboration**

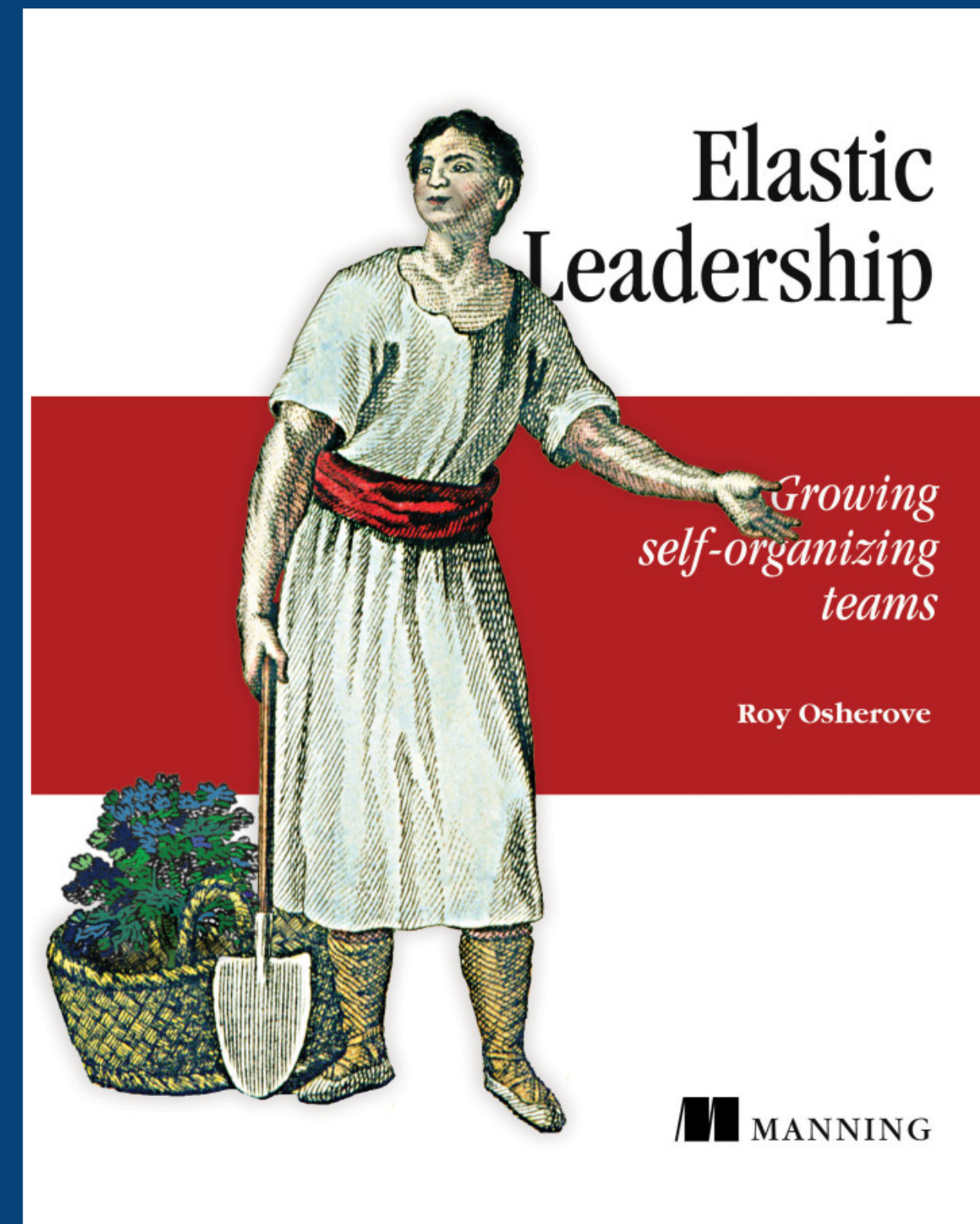
Software development is not a relay sport



AaaS

Architecture as a Service

Continuous
technical
leadership



Different types of teams need
different leadership styles



Pair architecting

Soft skills

(leadership, communication, presentation, influencing, negotiation, collaboration, coaching and mentoring, motivation, facilitation, political, etc)



Talking with Tech Leads

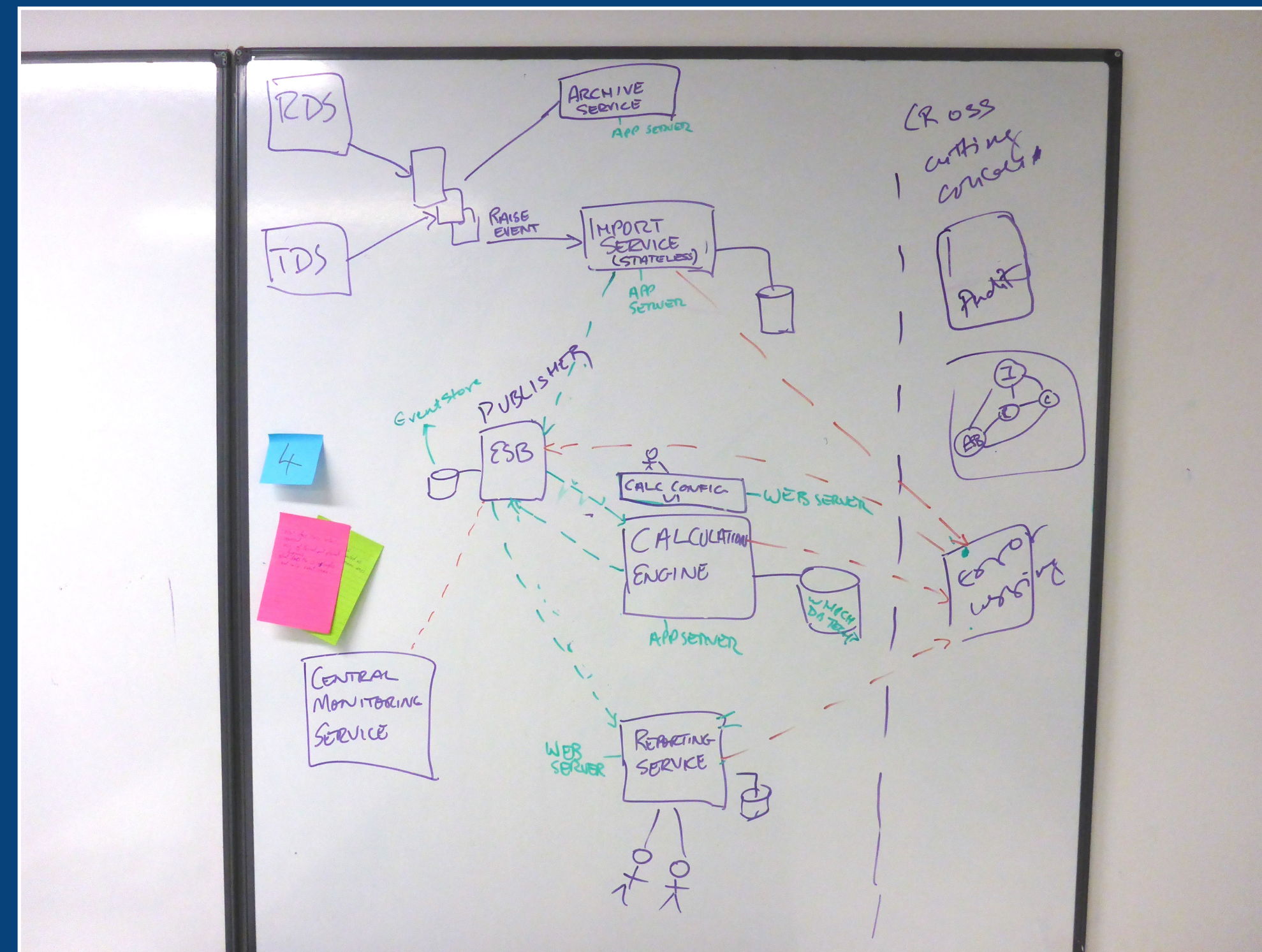
From Novices to Practitioners

Patrick Kua
Foreword by Jim Webber

Good software architects
are typically
good software developers

The people designing software must
understand technology ...
all decisions involve trade-offs

1. Is that what we're going to **build**?



2. Is it going to **work**?

Should software architects
write **code**?

Production code, prototypes,
frameworks, foundations, code
reviews, experimenting, etc

Don't code all of the time!

Software architects
should be
master builders

I am a senior developer. Recently, I was promoted to the position as architect. Could anyone please let me know which tools/software an architect should master/be familiar with. Thank you

Experience is important ...
software architecture is not a rank!

The video player displays a presentation slide and a live feed of the speaker, Mary Shaw, at the goto; conference. The slide, titled "software development methods", illustrates the evolution of software development practices. It is divided into three vertical columns: the first column (pink) contains "CRAFT" (red) and "PRODUCTION" (purple); the second column (yellow) contains "COMMERCE" (orange); and the third column (green) contains "PROFESSIONAL ENGINEERING" (green). A blue line labeled "SCIENCE" connects the top of the second and third columns. A red line connects "CRAFT" to "COMMERCE", and a purple line connects "PRODUCTION" to "COMMERCE". A green line connects "COMMERCE" to "PROFESSIONAL ENGINEERING". Annotations include: "PRODUCTION" with a line pointing to a circle on the purple line; "COMMERCE" with a line pointing to a circle on the orange line; and "~ 1990, adoption of development methods" with a line pointing to the intersection of the red and purple lines. The text "emerging, but spotty" is written near the "PROFESSIONAL ENGINEERING" box. The video player interface at the bottom shows a red progress bar, playback controls (play, pause, volume), a timestamp of 45:01 / 54:25, and icons for closed captions, settings, and full screen. The speaker, Mary Shaw, is visible in the bottom right corner, standing at a podium with the goto; logo.

Progress Toward an Engineering Discipline of Software

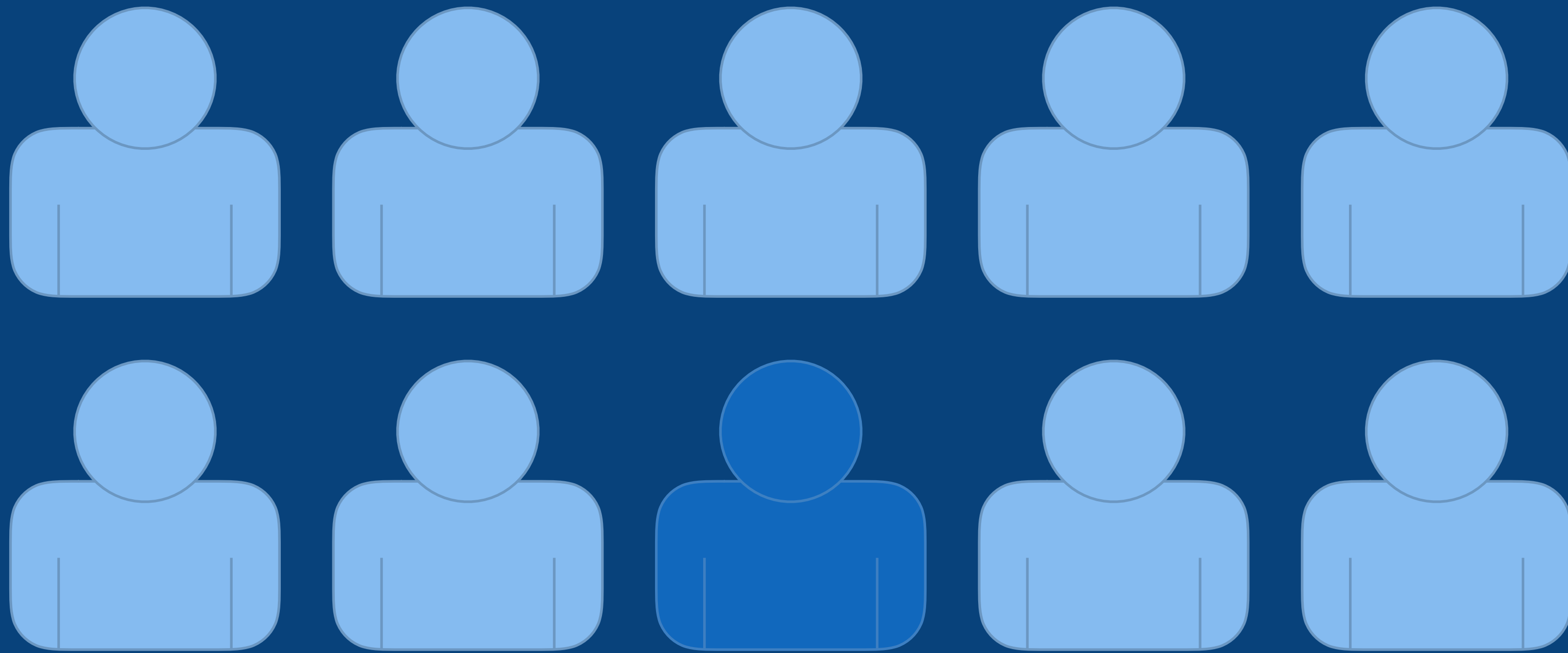
Mary Shaw

The software architecture role is **multi-faceted**

(technical depth, technical breadth, soft skills)

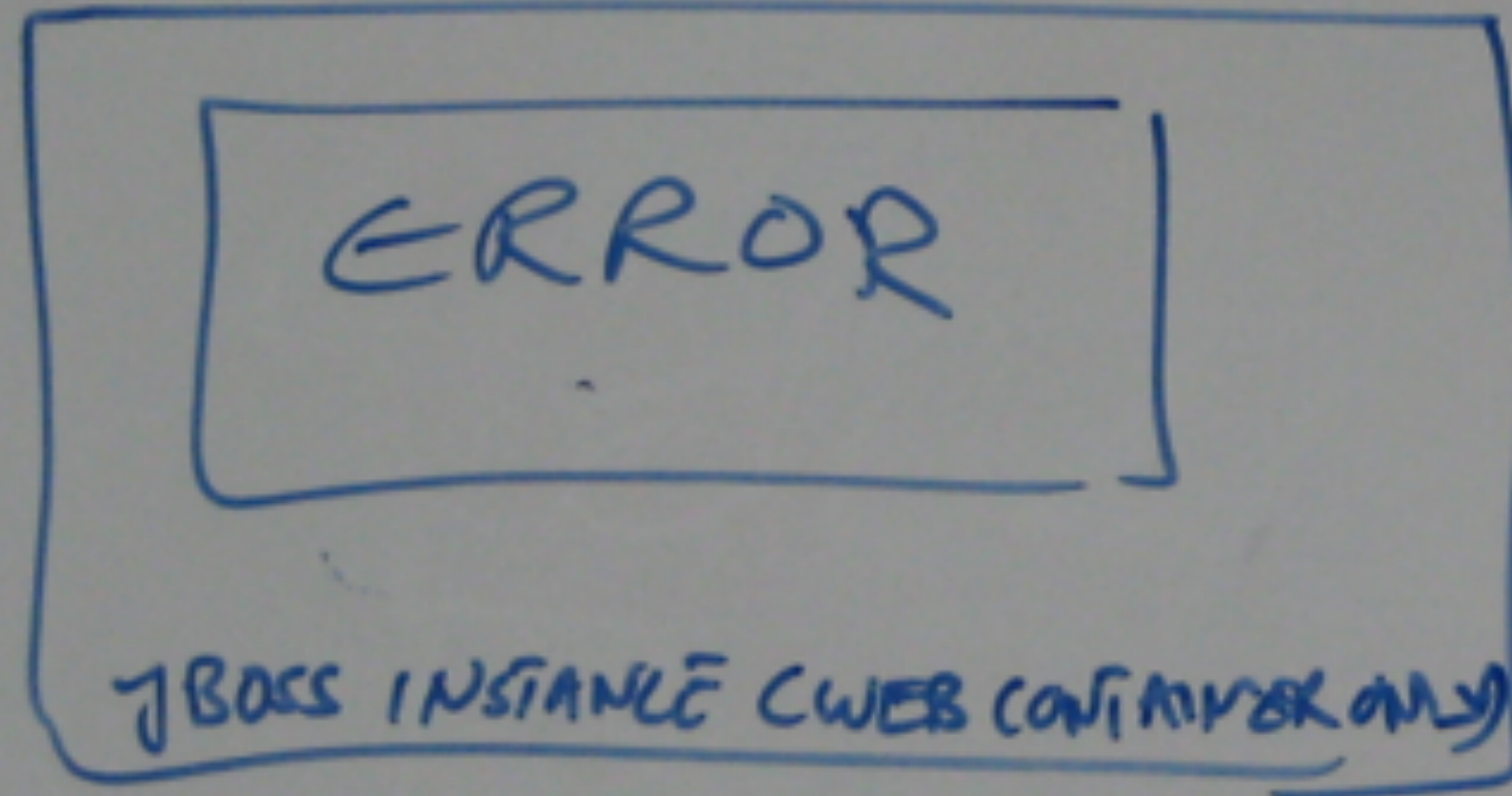
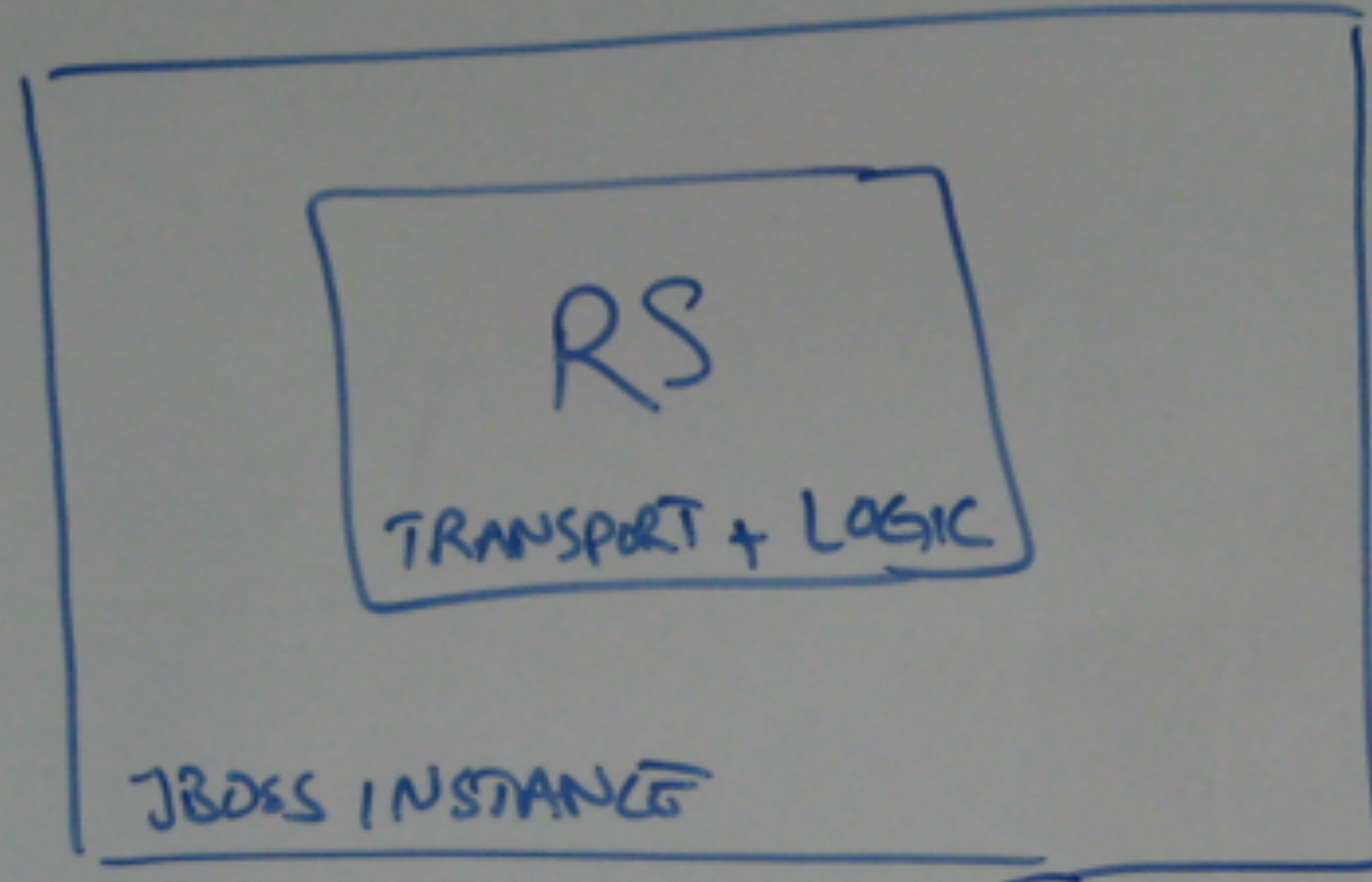
4. You don't need to use UML

Do *you* use UML?

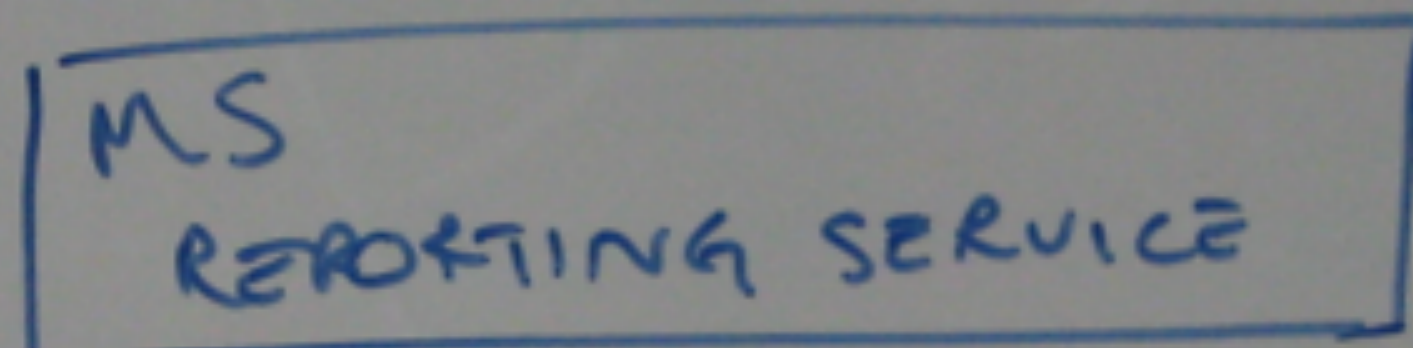
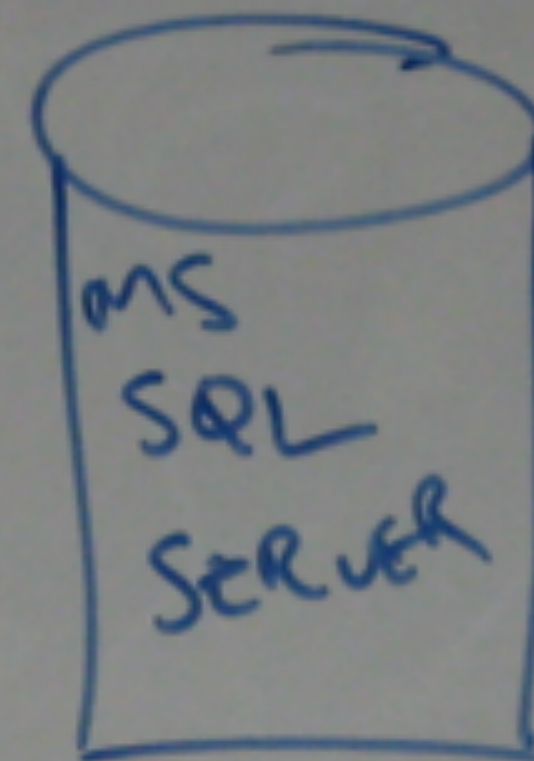


In my experience, optimistically,
1 out of 10 people use UML

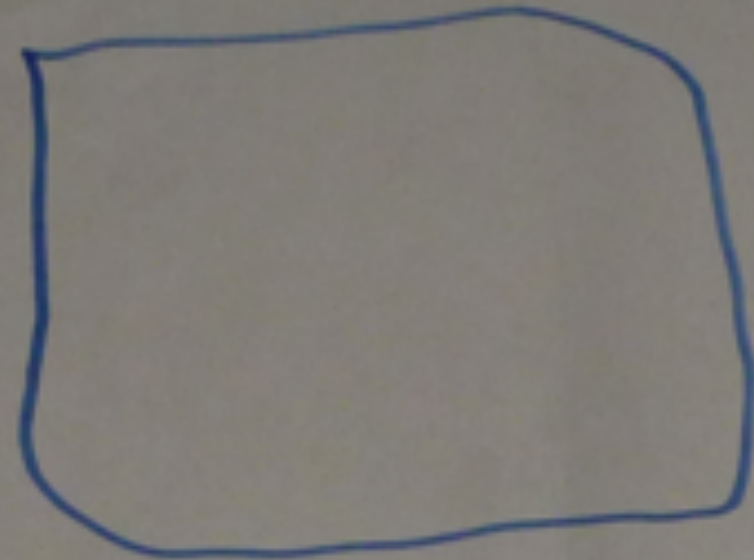
UNIX BOX



WINDOWS BOX



ASP
NET



LOGGING
SERVICE

PARAMETER
MANAGER

RISK
CALCULATION

REPORT
GENERATOR

DATA
IMPORT

AUDITING

VALIDATION

server

TDS

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RISK
DATA

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SECURITY

AUDIT

FUNCTIONAL VIEW

File Retriever

Scheduler

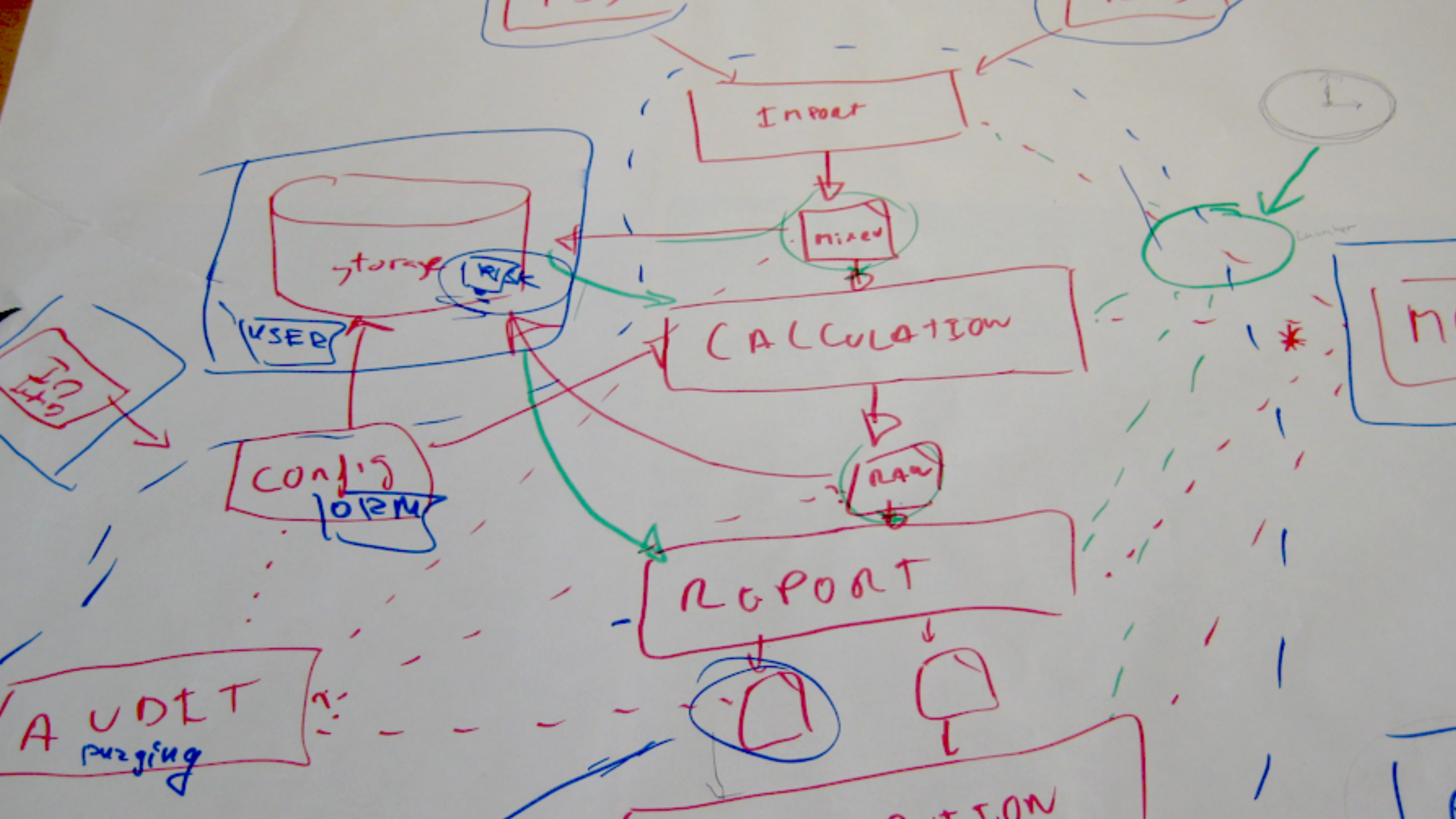
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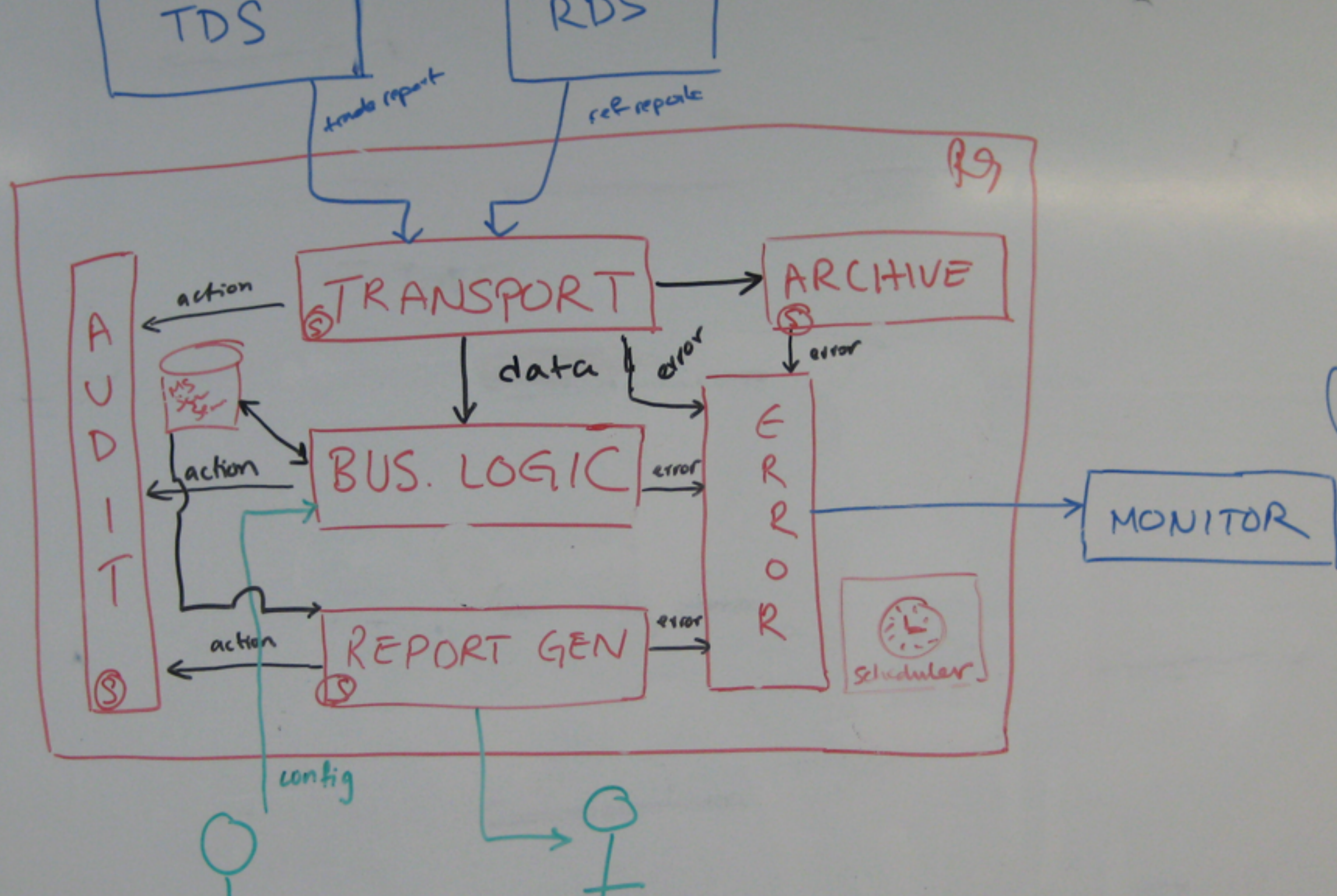
Reference
Archiver

Risk Assessment
Processor

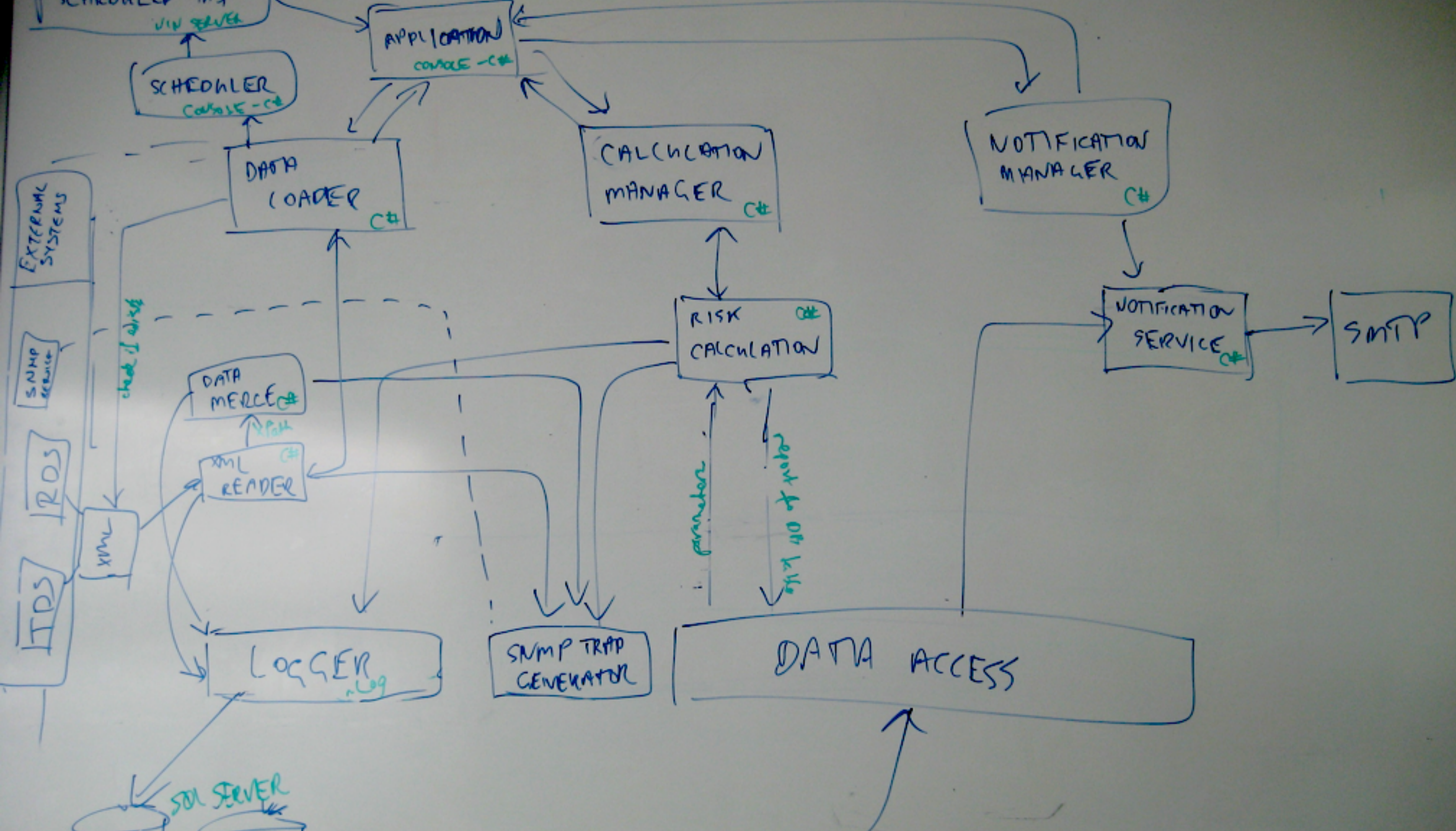
Risk Parameter
Configuration

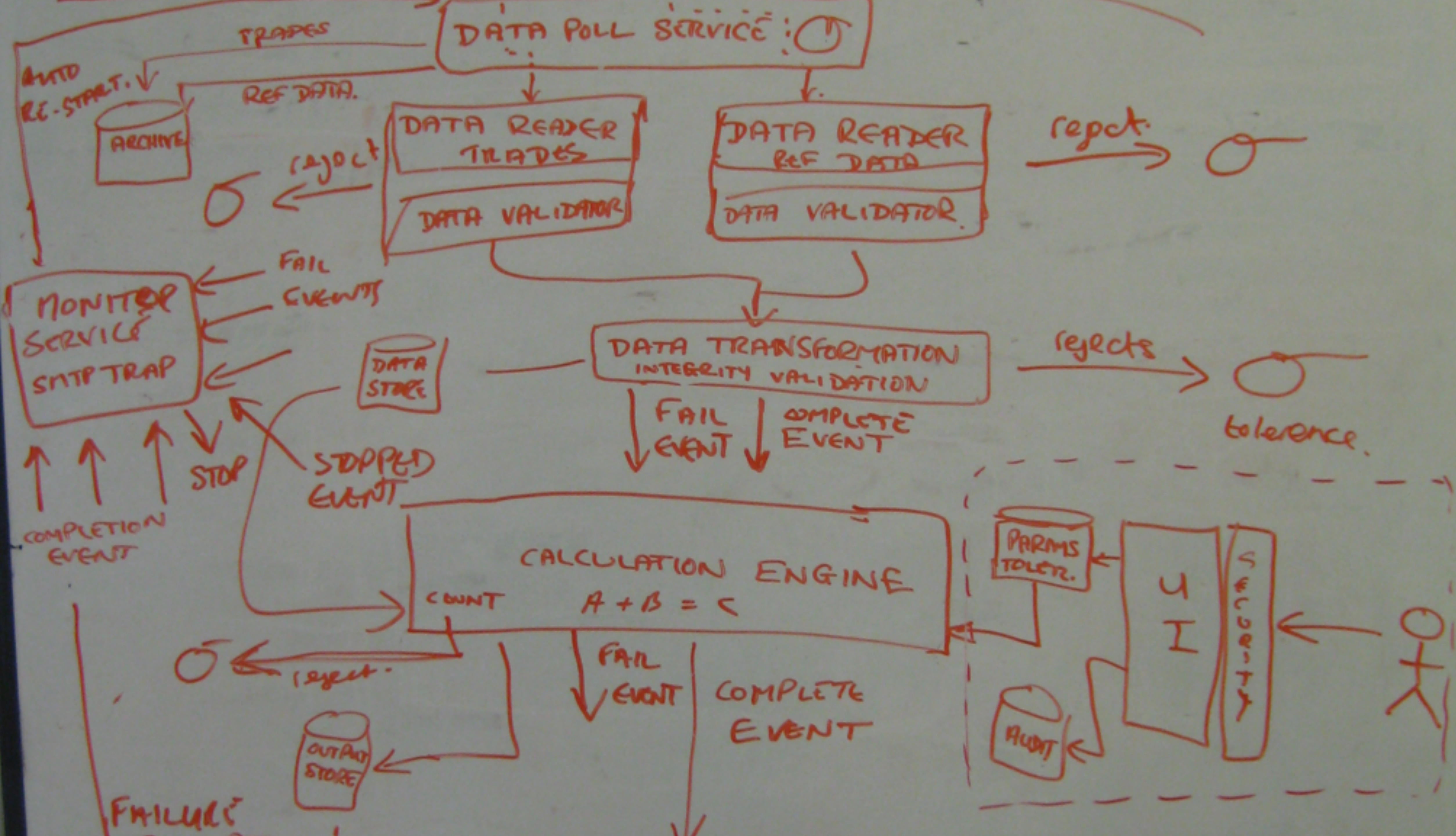
Report

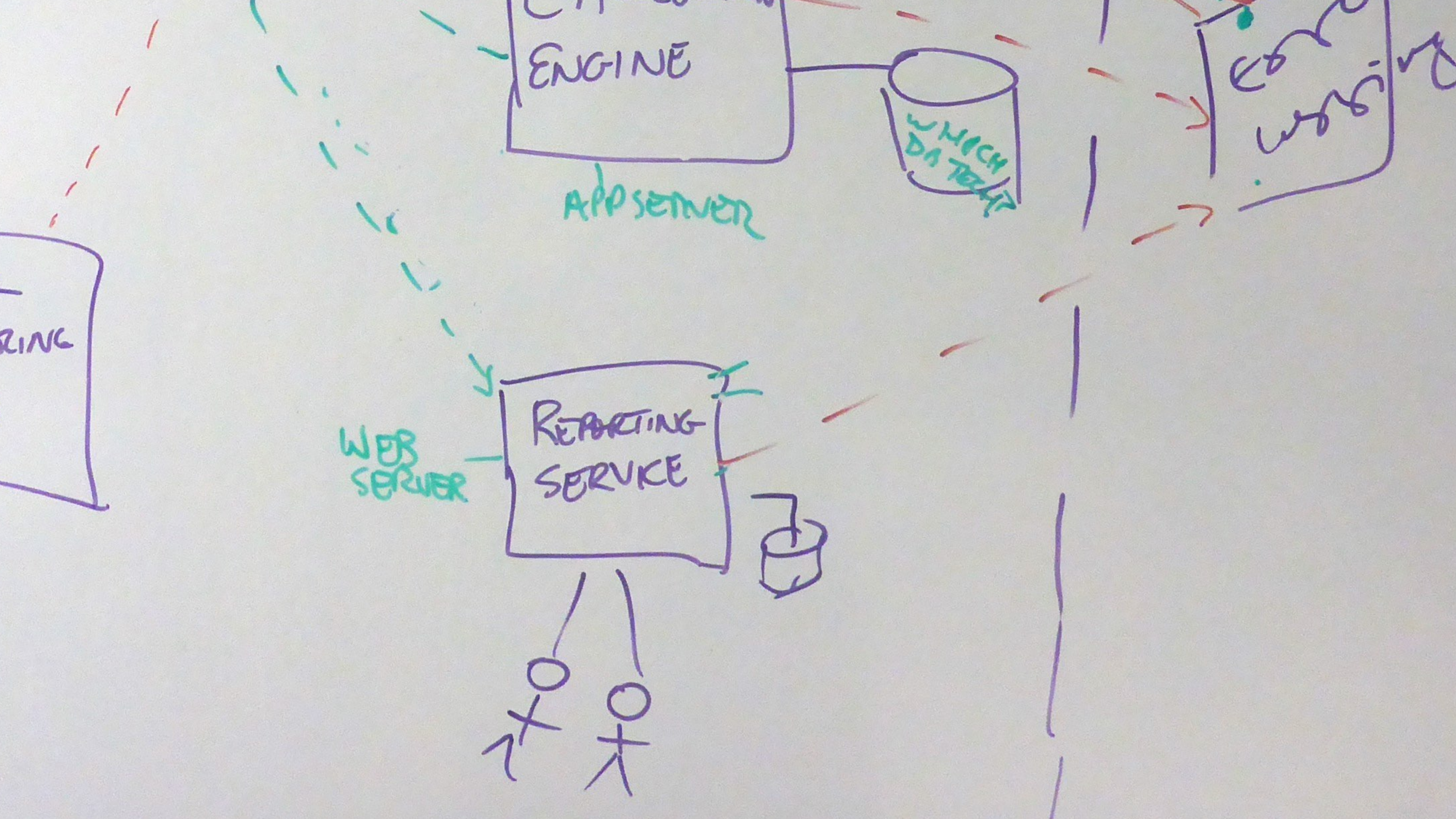












Params

Calcs

Params

ret - client

ret - client

~~Calcs~~ Risk outputs

Flow App Log

EH?

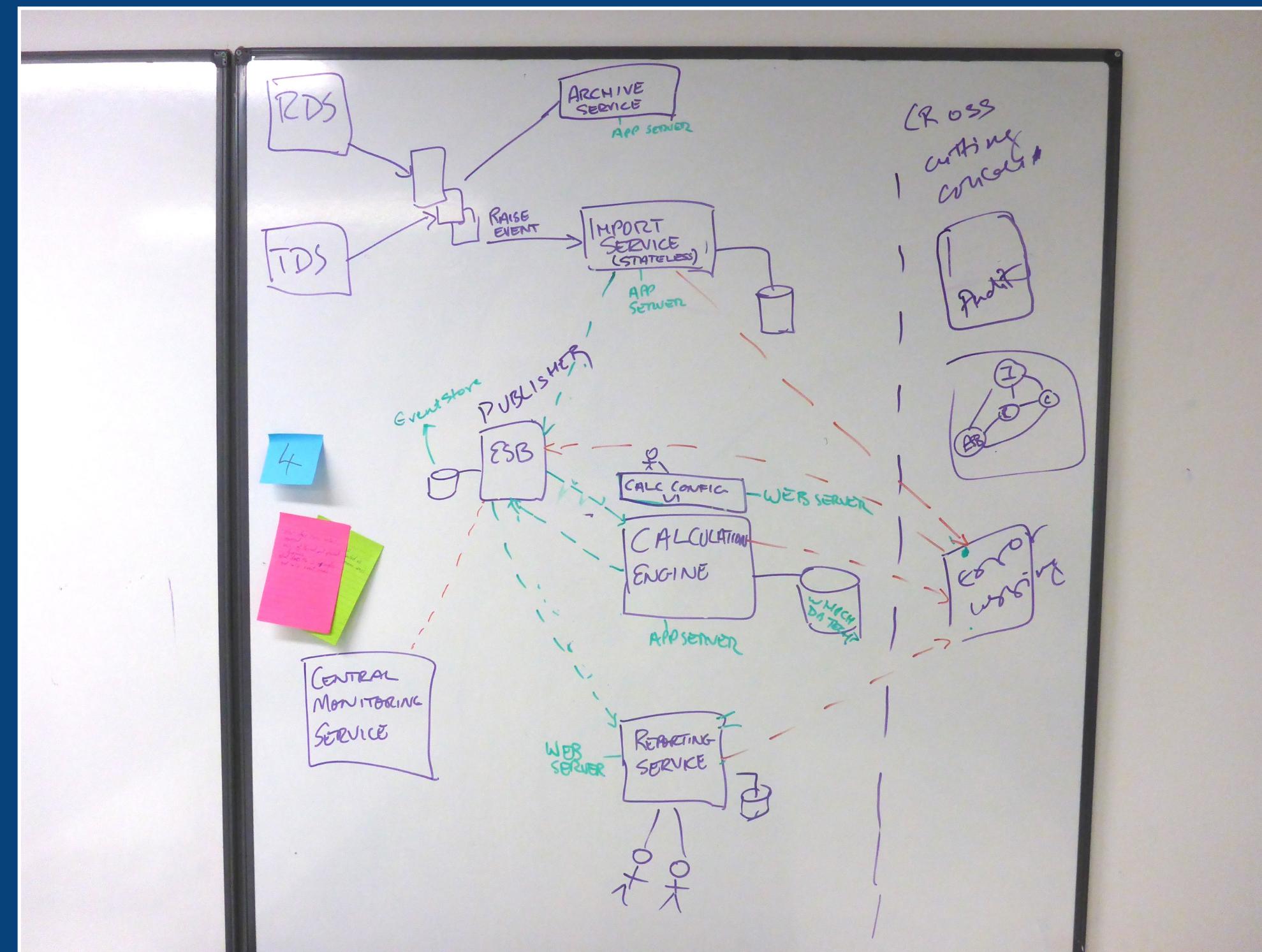
App
Flow Log
Date
- Risk Cell
- calcs
- Par

Params - Distinct

Batch

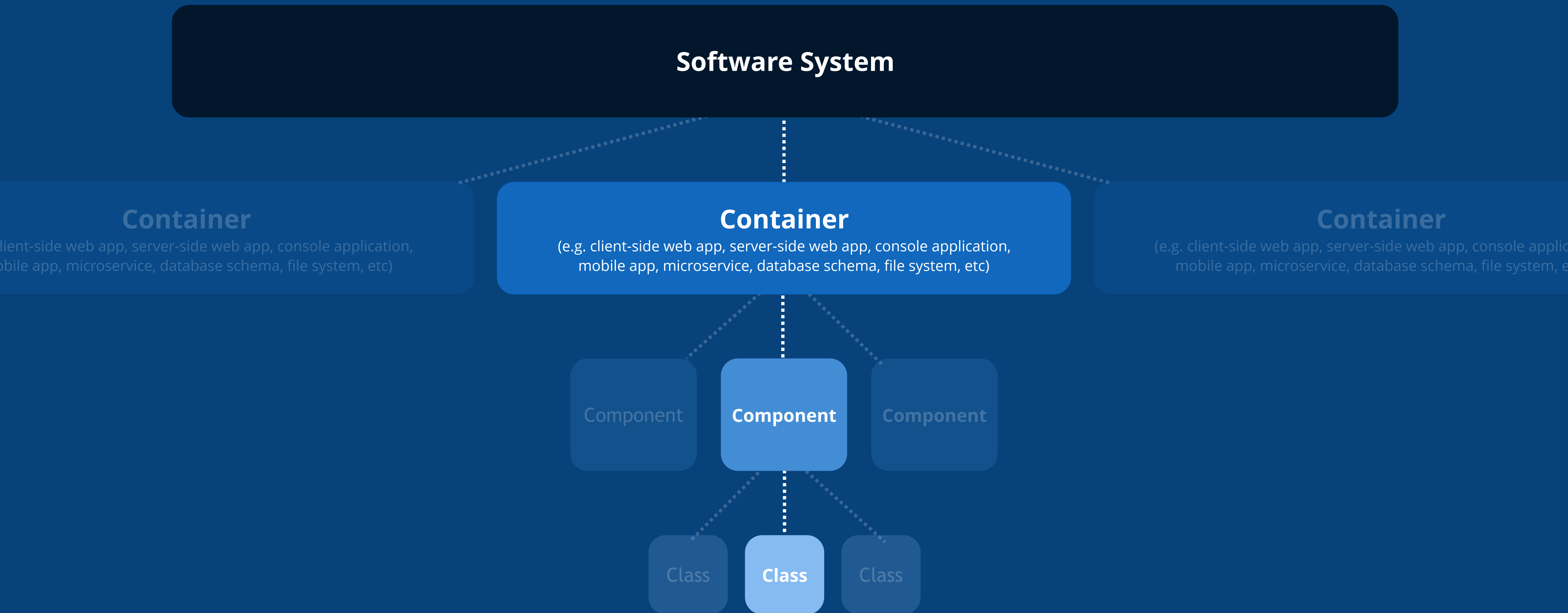
Batch
B-id:
cust id

1. Is that what we're going to **build**?



2. Is it going to **work**?

A common set of abstractions
is more important
than a common notation



A **software system** is made up of one or more **containers**,
each of which contains one or more **components**,
which in turn are implemented by one or more **classes** (or **code**).

C4

c4model.com

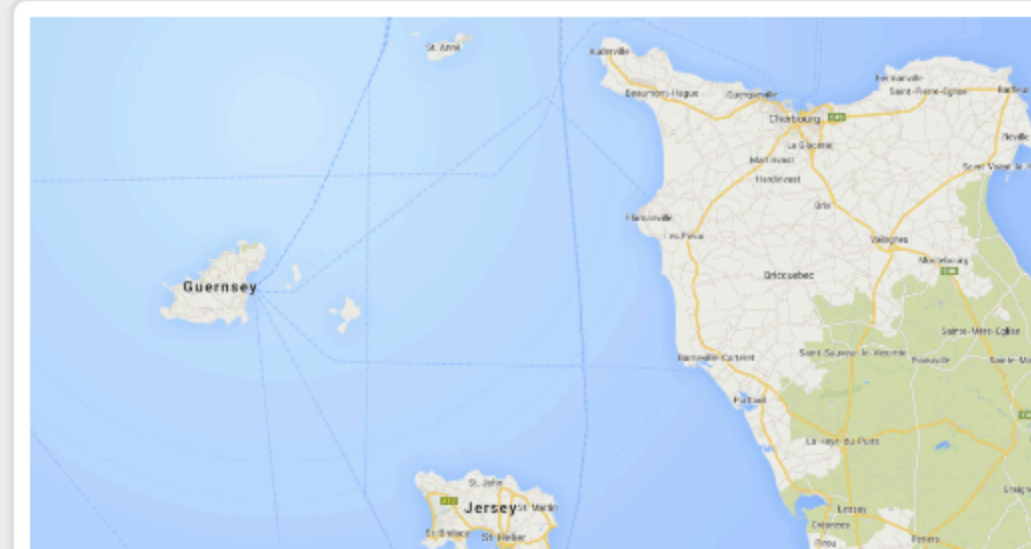
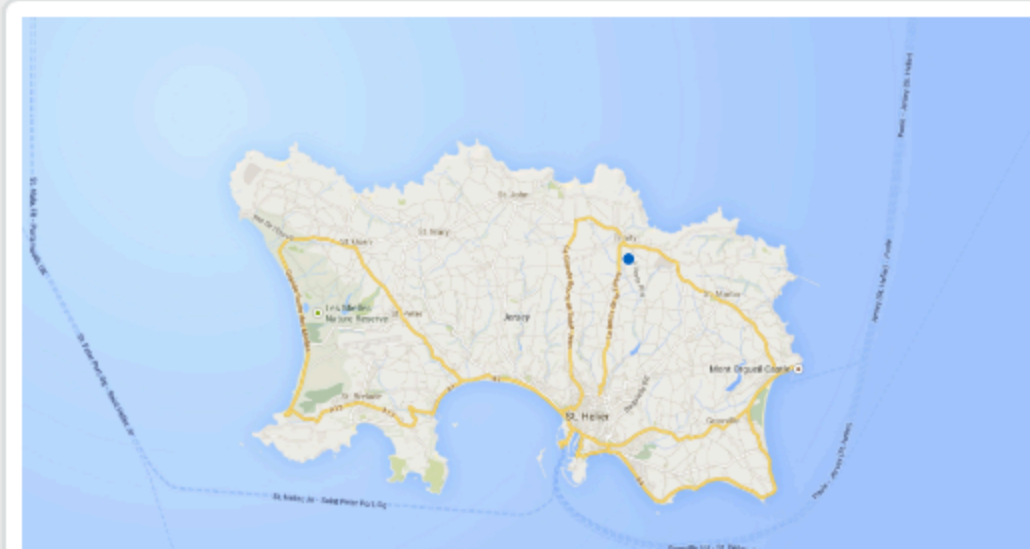
The C4 model for software architecture

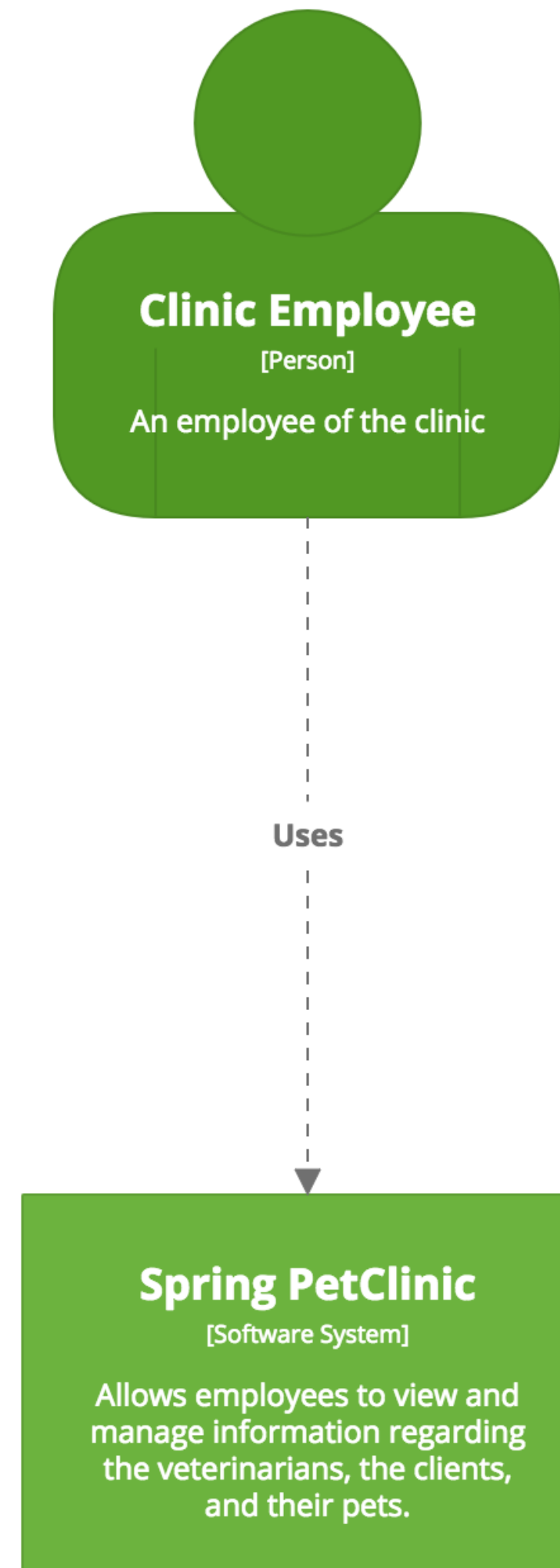
Context, Containers, Components and Classes (or Code)

Abstractions Core diagrams Supplementary diagrams Notation Tooling Training

Maps of your code

The C4 model was created as a way to help software development teams describe and communicate software architecture, both during up-front design sessions and when retrospectively documenting an existing codebase. It's a way to create **maps of your code**, at various levels of detail, in the same way you would use something like Google Maps to zoom in and out of an area you are interested in.

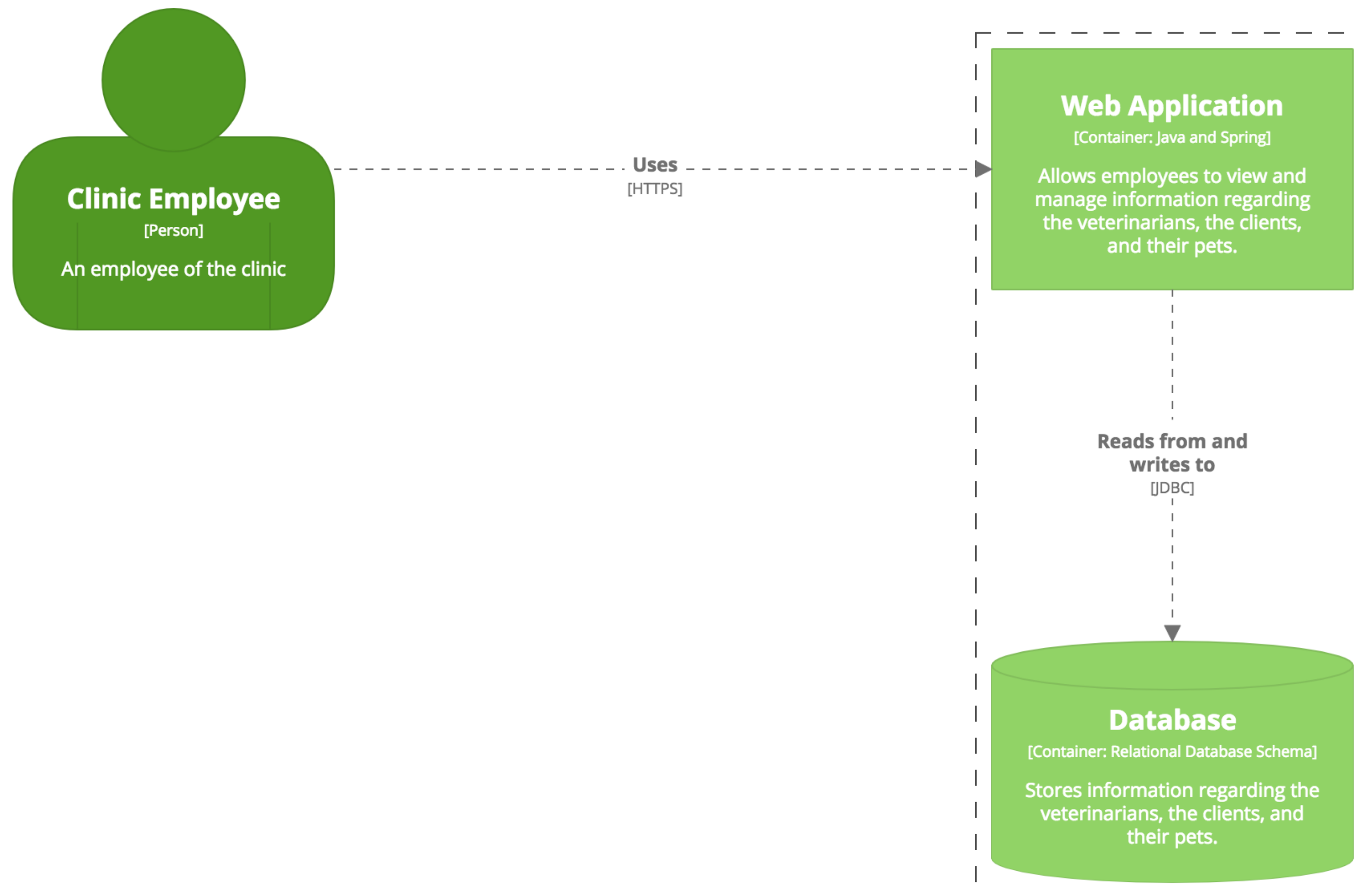




System Context diagram for Spring PetClinic

The System Context diagram for the Spring PetClinic system.

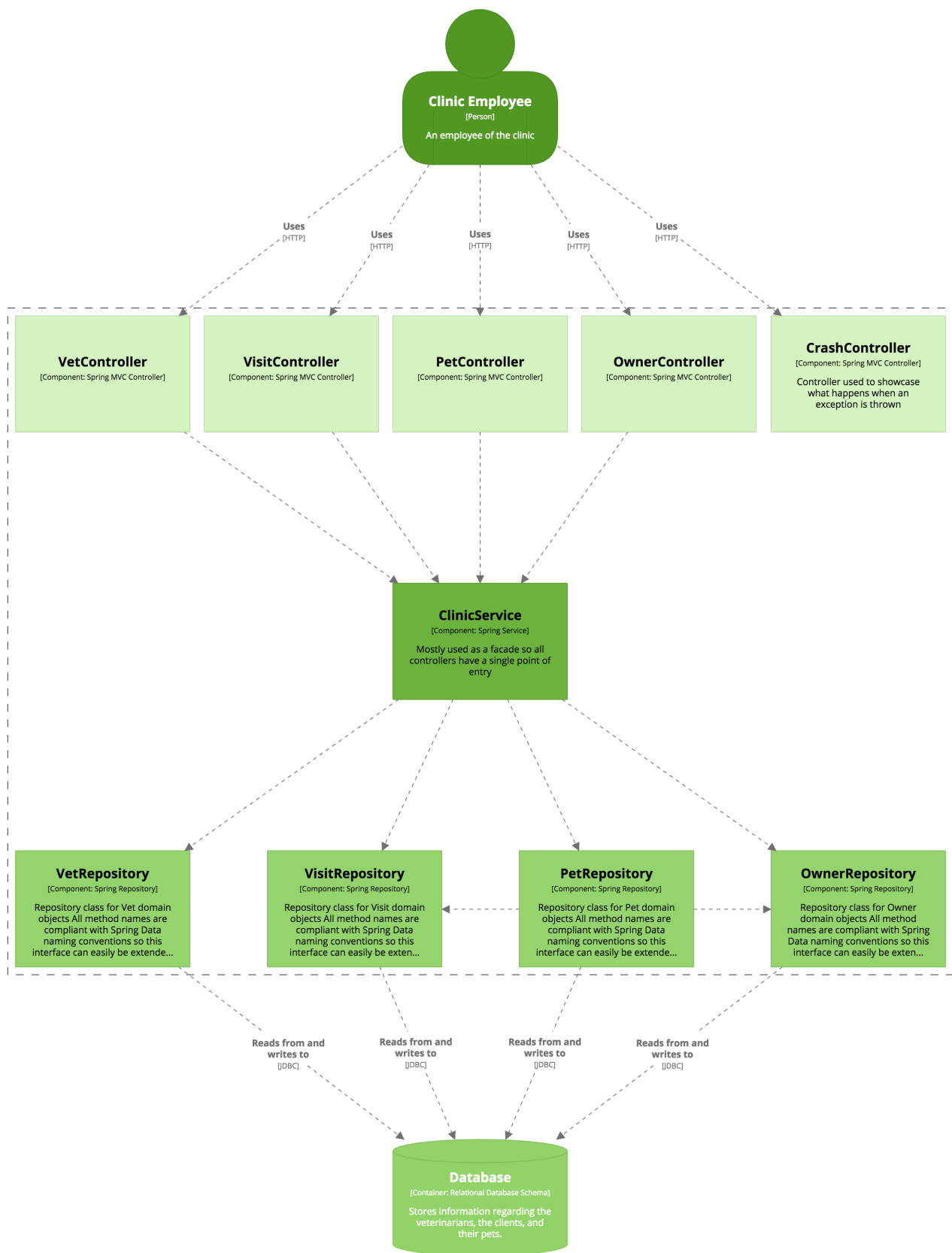
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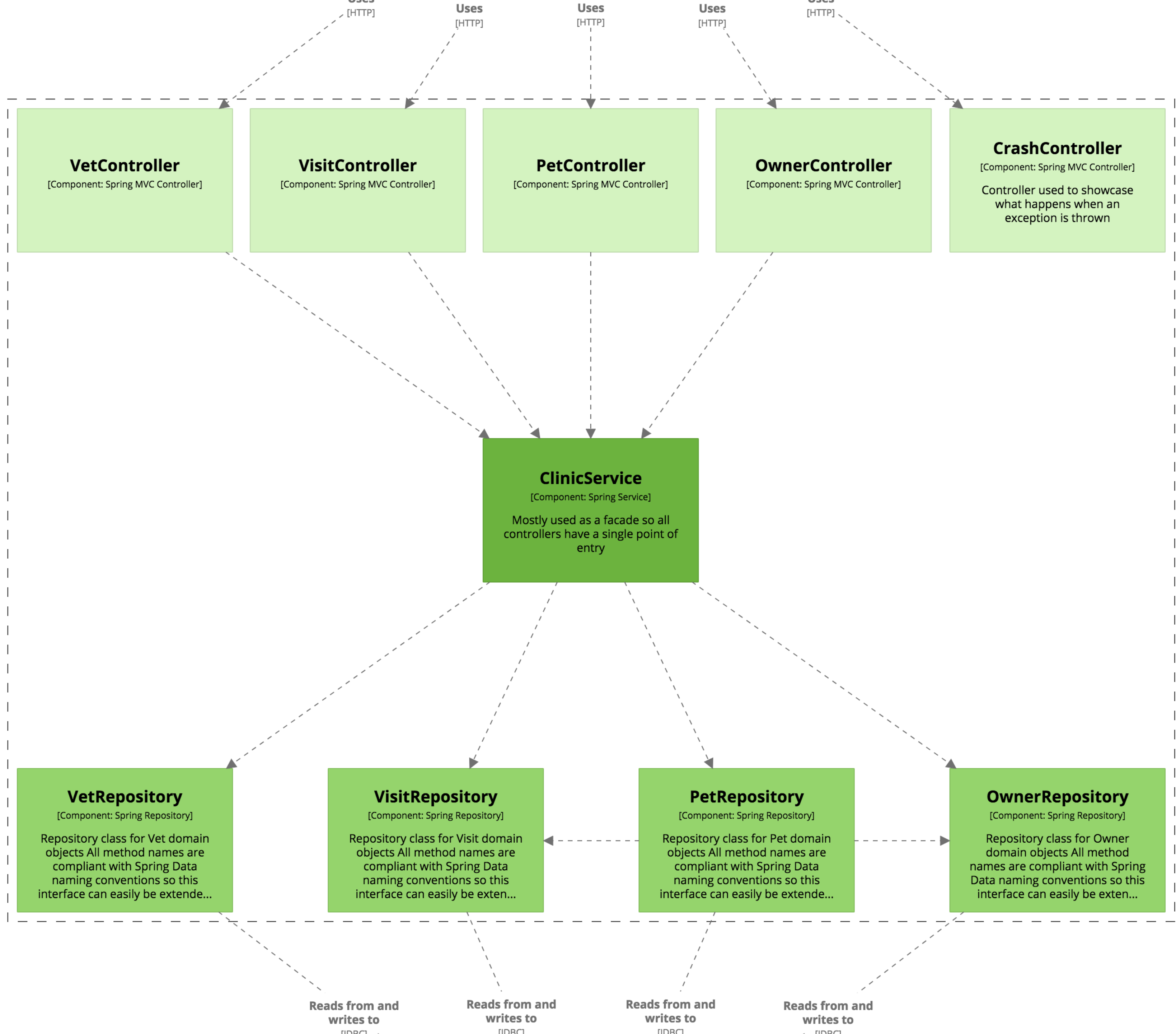
Container diagram for Spring PetClinic

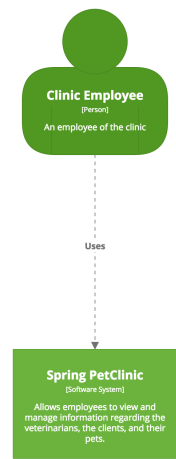
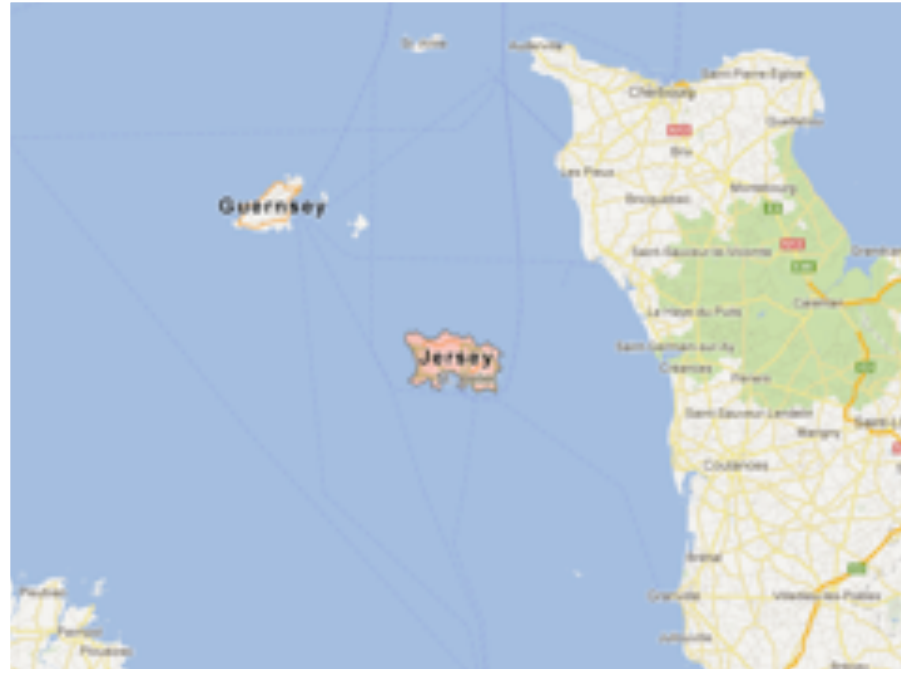
The Containers diagram for the Spring PetClinic system.

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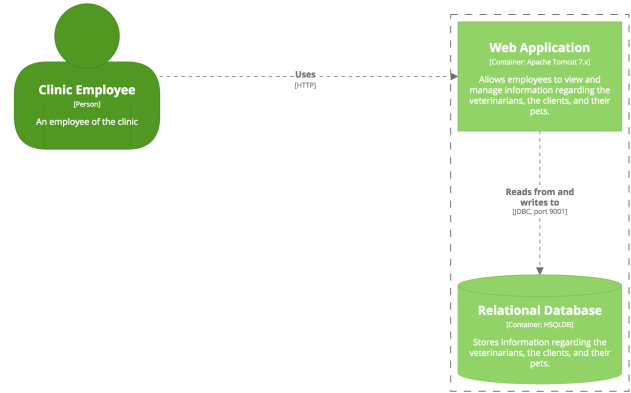


Component diagram for Spring PetClinic - Web Application
The Components diagram for the Spring PetClinic web application.
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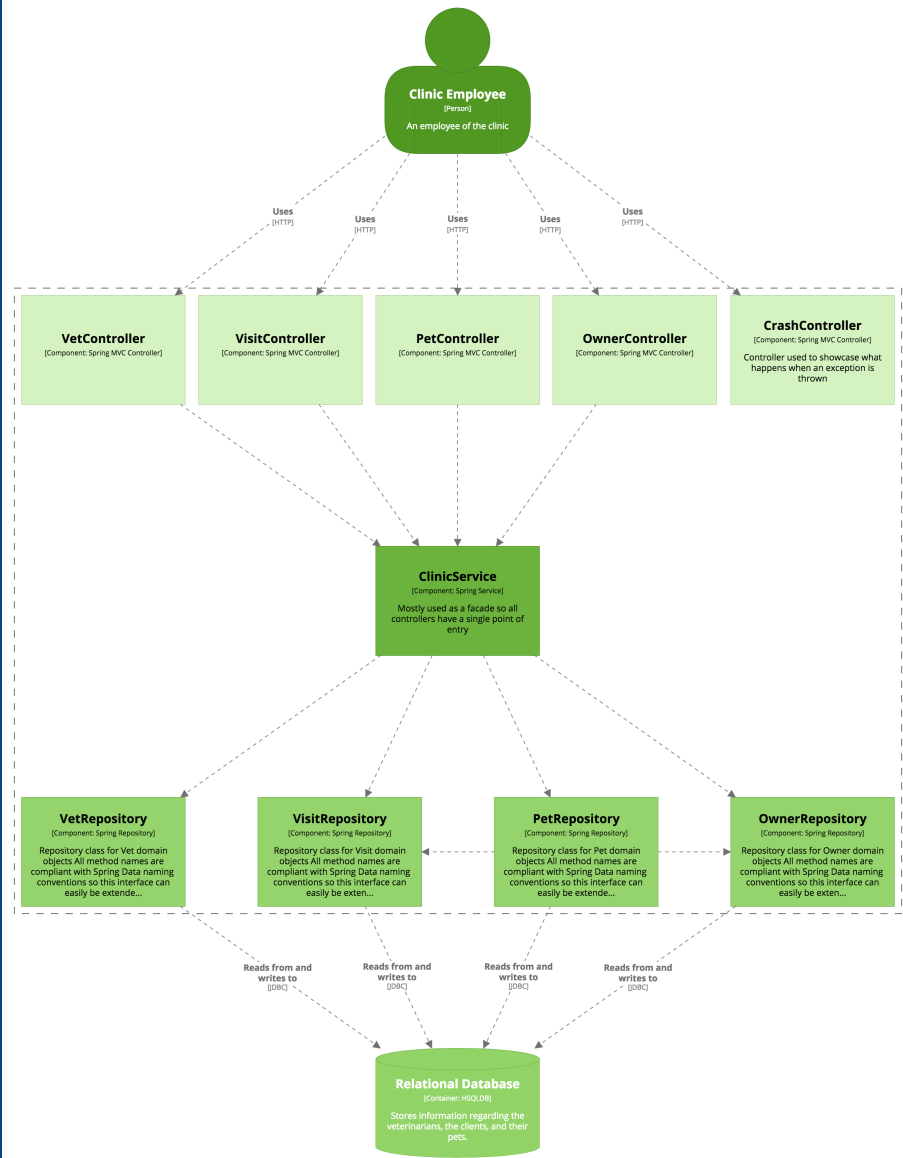




System Context diagram for Spring PetClinic
The system context diagram for the Spring PetClinic system.
Friday 18 November 2016 22:21 UTC



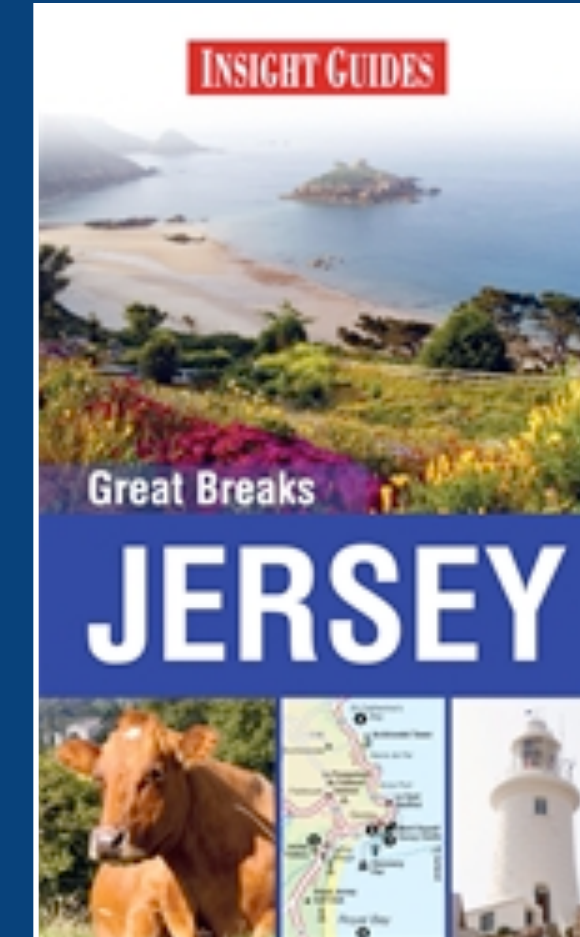
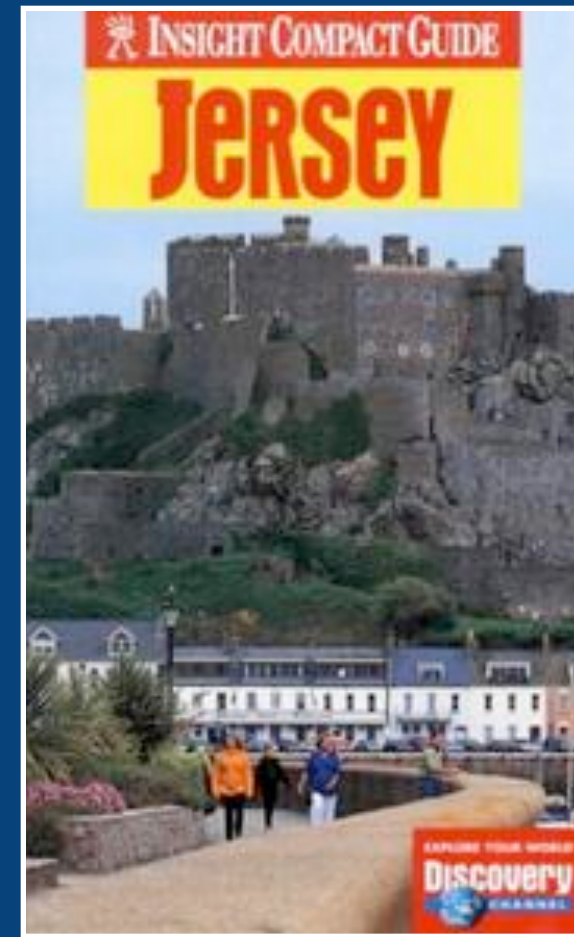
Container diagram for Spring PetClinic
The container diagram for the Spring PetClinic system.
Friday 18 November 2016 22:21 UTC



Component diagram for Spring PetClinic - Web Application
The components diagram for the Spring PetClinic web application.
Friday 18 November 2016 22:21 UTC

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GitHub
spring-projects / spring-petclinic
2 contributors
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Software Guidebook

(maps, points of interest, sights, itineraries, history, culture, practical information, etc)

The background features four light blue parallelograms arranged in two pairs, one pair on the left and one pair on the right, framing the central text.

What **tools** do you
recommend?

```
public static void main(String[] args) throws Exception {  
    Workspace workspace = new Workspace("Getting Started", "This is a model of  
    Model model = workspace.getModel();  
  
    Person user = model.addPerson("User", "A user of my software system.");  
    SoftwareSystem softwareSystem = model.addSoftwareSystem("Software System",  
    user.uses(softwareSystem, "Uses");  
  
    ViewSet views = workspace.getViews();  
    SystemContextView contextView = views.createSystemContextView(softwareSystem);  
    contextView.addAllSoftwareSystems();  
    contextView.addAllPeople();  
  
    Styles styles = views.getConfiguration().getStyles();  
    styles.addElementStyle(Tags.SOFTWARE_SYSTEM).background("#1168bd").color("white");  
    styles.addElementStyle(Tags.PERSON).background("#08427b").color("white");  
}
```

```
static void Main()
{
    Workspace workspace = new Workspace("Getting Started", "This is a model of
    Model model = workspace.Model;

    Person user = model.AddPerson("User", "A user of my software system.");
SoftwareSystem softwareSystem = model.AddSoftwareSystem("Software System",
user.Uses(softwareSystem, "Uses");

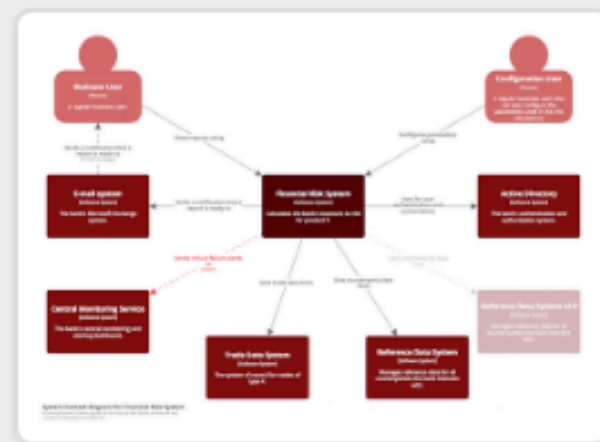
    ViewSet viewSet = workspace.Views;
SystemContextView contextView = viewSet.CreateSystemContextView(softwareSy
contextView.AddAllSoftwareSystems();
contextView.AddAllPeople();

    Styles styles = viewSet.Configuration.Styles;
    styles.Add(new ElementStyle(Tags.SoftwareSystem) { Background = "#1168bd",
    styles.Add(new ElementStyle(Tags.Person) { Background = "#08427b", Color =
}
```



Structurizr

Visualise, document and explore your software architecture



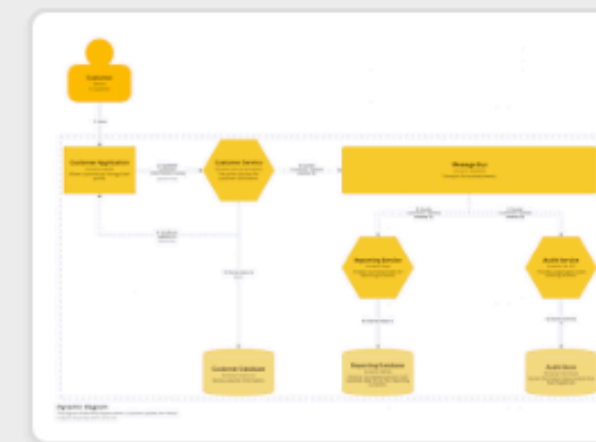
Create system context diagrams using Java code.



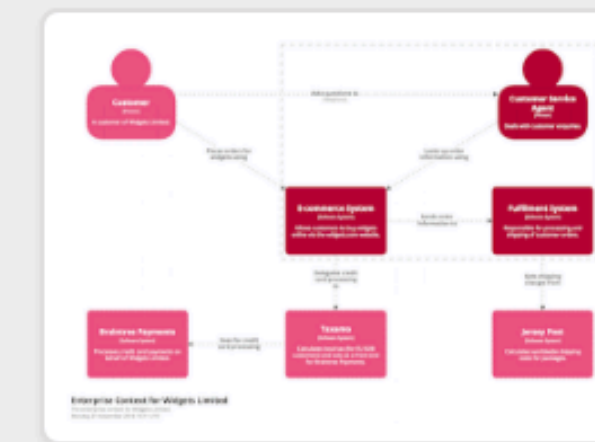
Extract components from your Java codebase, using static analysis and reflection.



Client-side encrypt your workspace for additional security ('password').



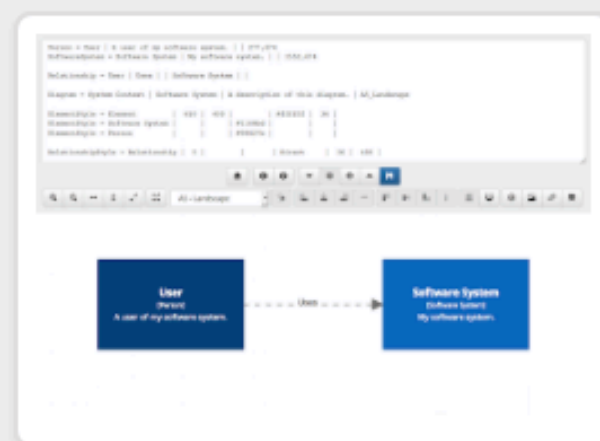
Create animated diagrams to describe dynamic behaviour.



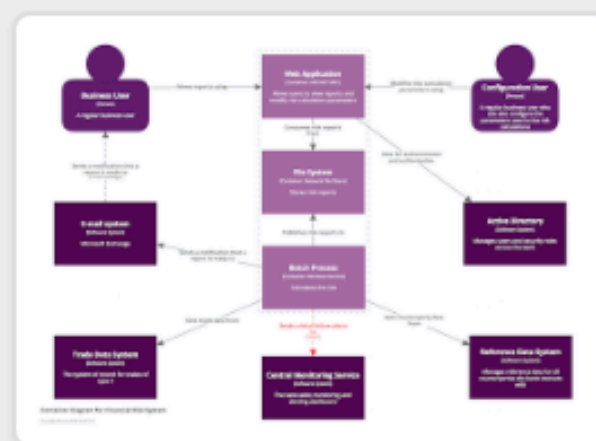
Create enterprise context diagrams using code.



Document your software with Markdown and AsciiDoc, effortlessly embed diagrams.



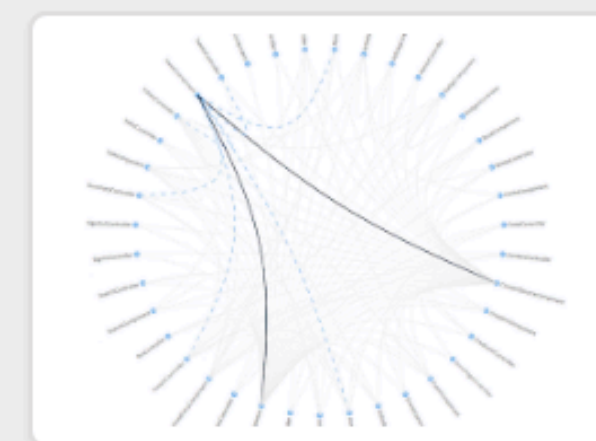
Create diagrams using text with Structurizr Express.



Create diagrams using C# code.



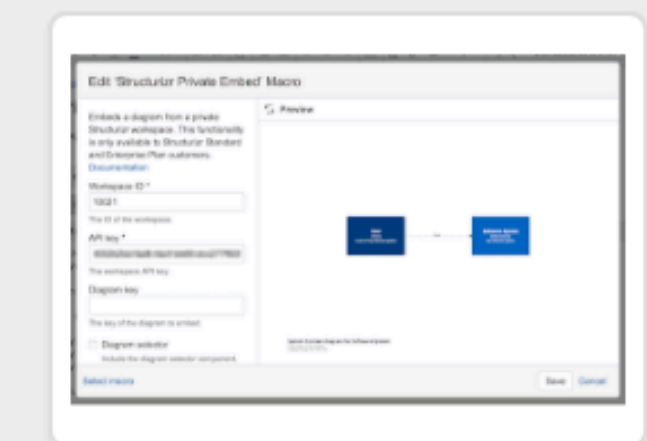
Extract components from your .NET codebase, using static analysis and reflection.



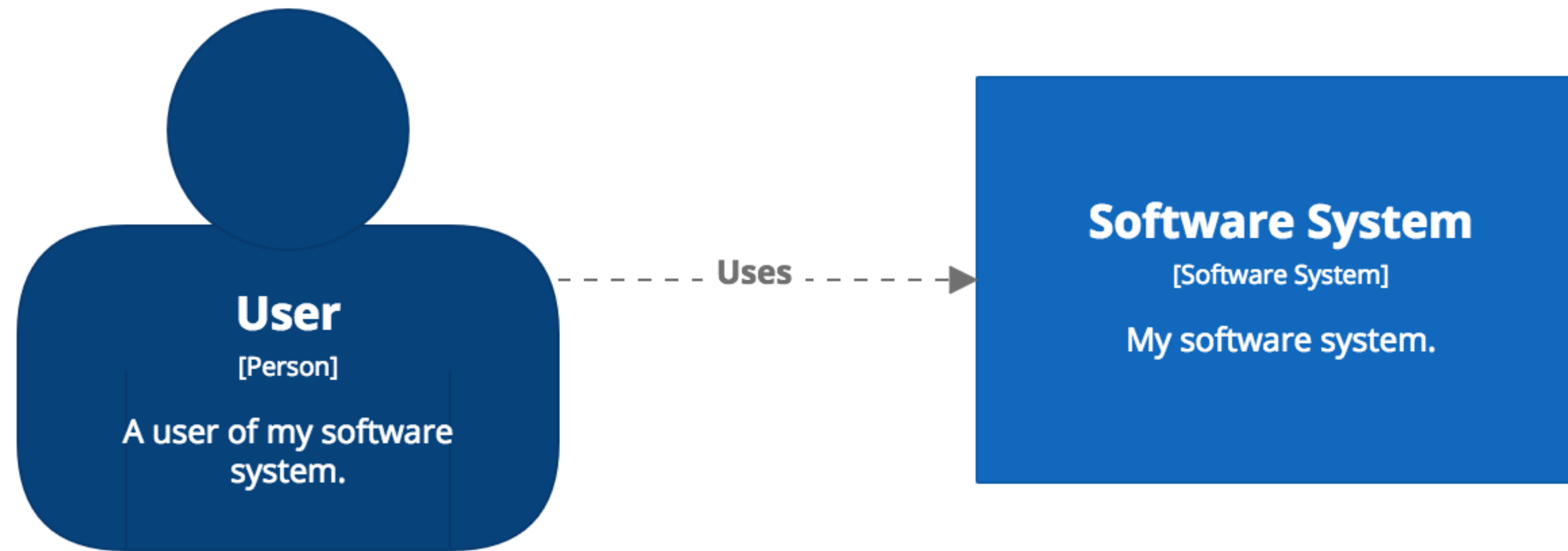
Explore inbound, outbound and cyclic dependencies between components.



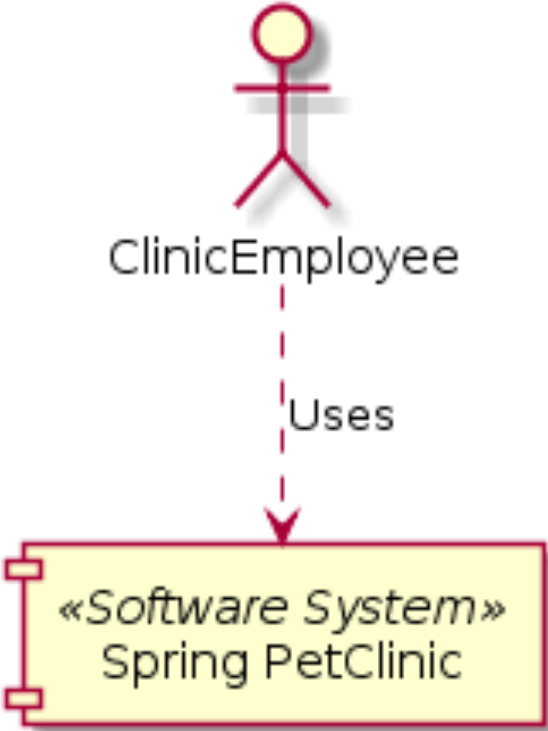
Explore component size.



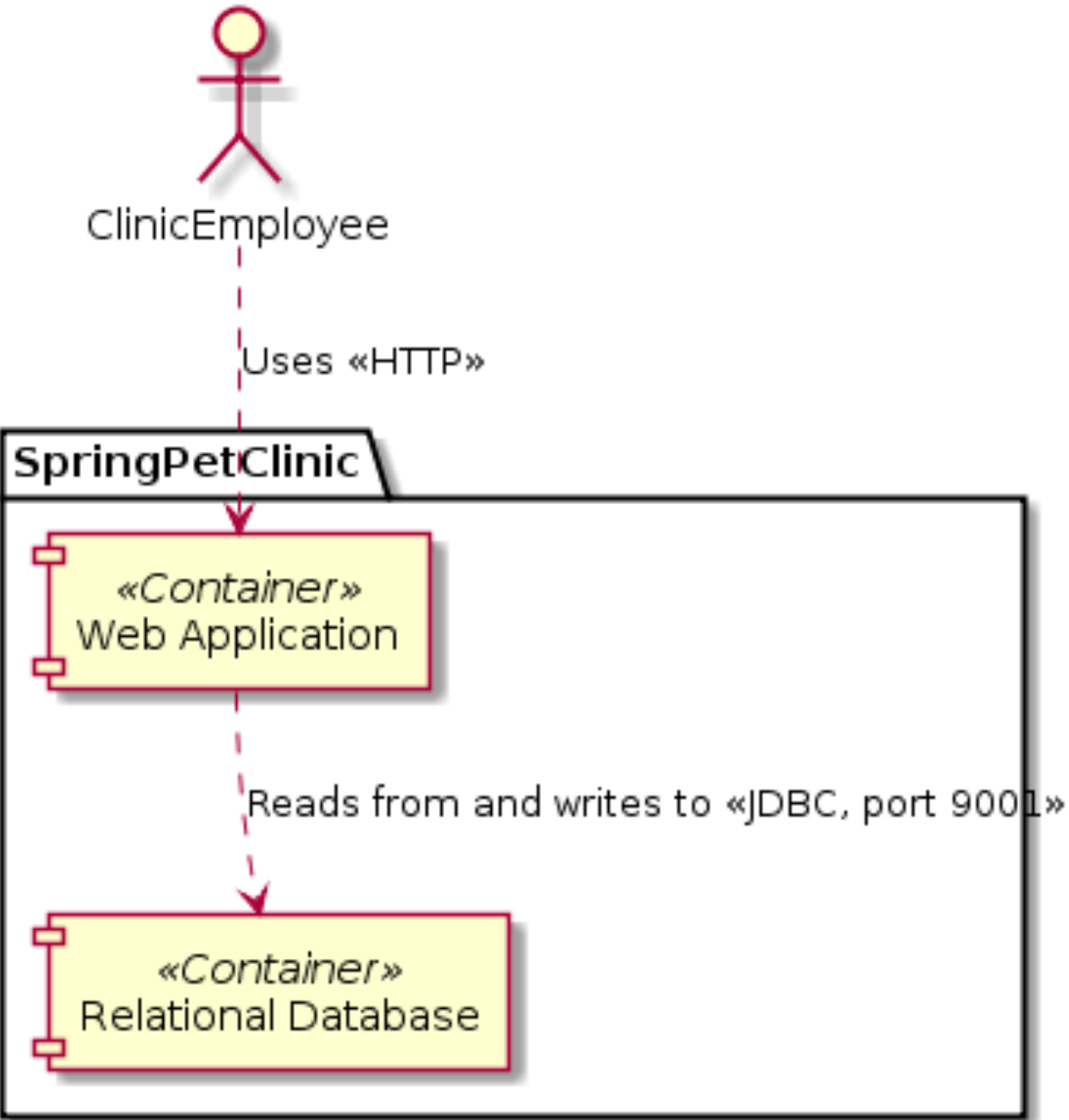
Embed diagrams into Atlassian Confluence with prebuilt macros.



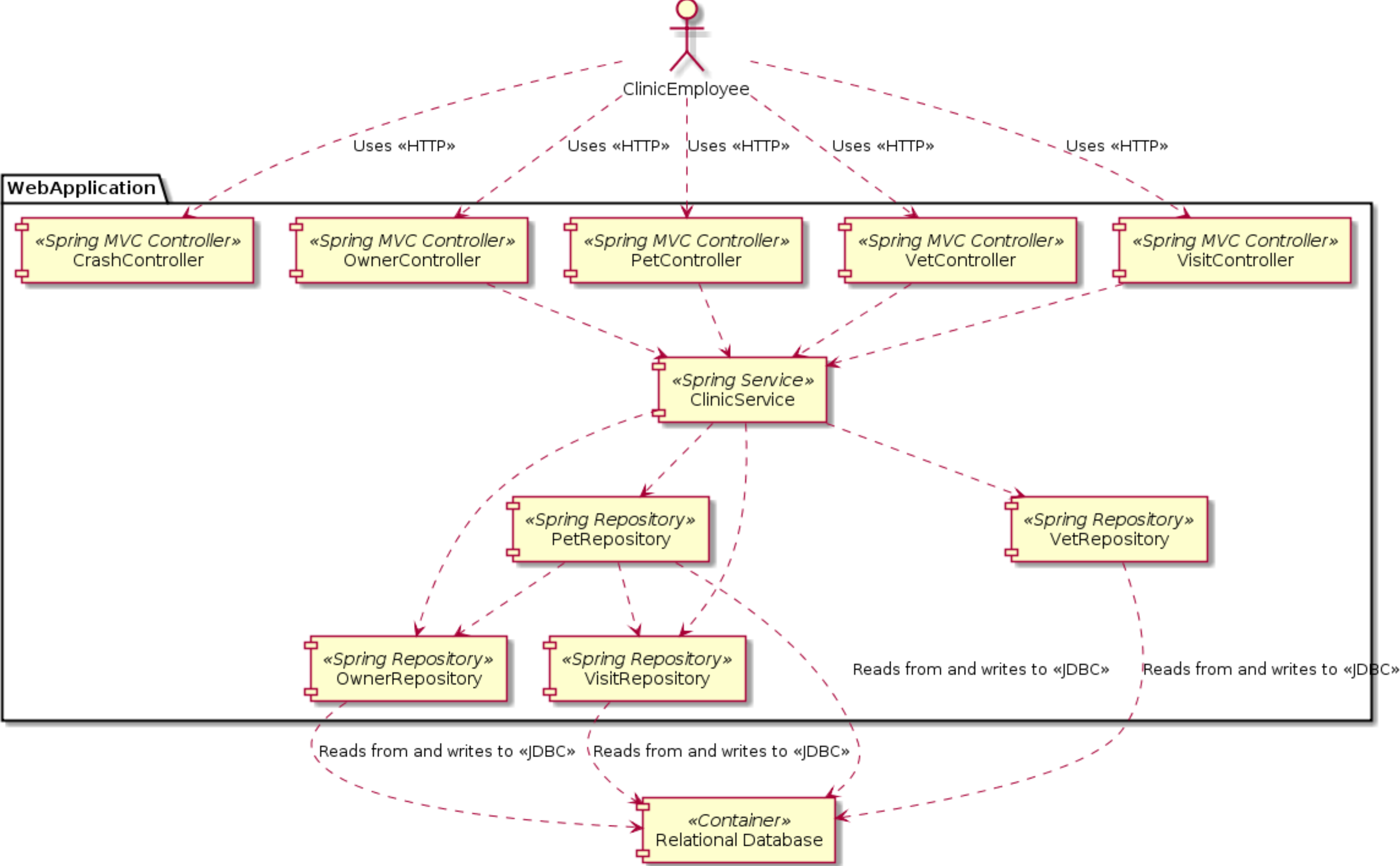
Spring PetClinic - System Context



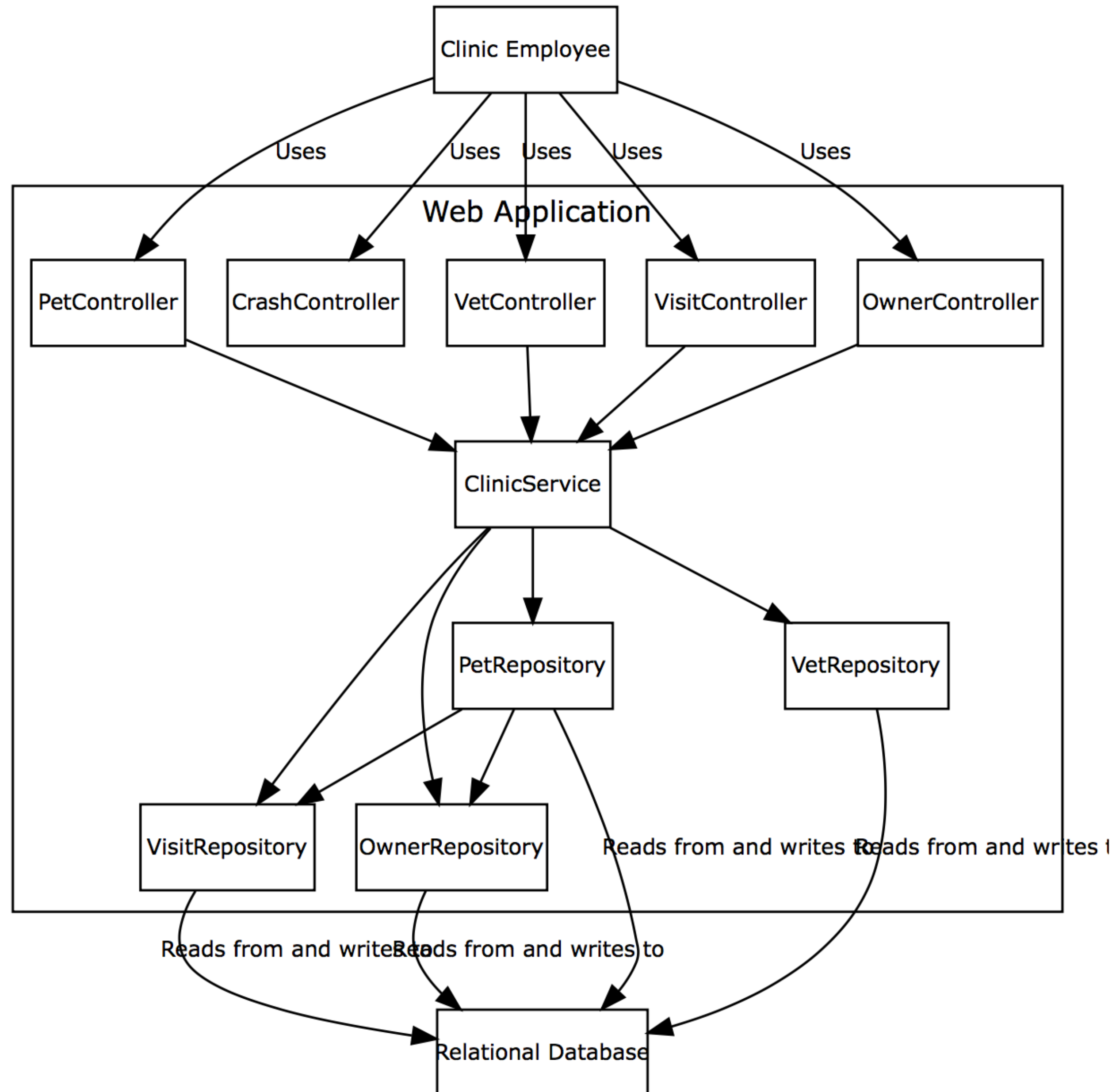
Spring PetClinic - Containers



Spring PetClinic - Web Application - Components



Spring PetClinic - Web Application - Components





Simon Brown

@simonbrown



“Visualising and documenting software architecture cheat sheets” -> codingthearchitecture.com/2017/04/27/vis...

or a software system in terms of containers, components and classes (or code):

A **software system** is made up of one or more **containers** (web applications, mobile apps, desktop applications, databases, file systems, etc), each of which contains one or more **components**, which in turn are implemented by one or more **classes** (or **code**).

2 Visualise this hierarchy by creating a collection of System Context, Container, Component and (optionally) UML class diagrams. Think about these diagrams as maps of your software, showing different levels of detail.

Level 1: System Context

A System Context diagram is a good starting point for diagramming and documenting a software system, allowing you to step back and see the big picture. Draw a diagram showing your system as a box in the centre, surrounded by its users and the other systems that it interacts with. Detail isn't important here as this is your zoomed out view showing a big picture of the system landscape. The focus should be on people (actors, roles, personas, etc) and software systems rather than technologies, protocols and other low-level details.

Level 2: Containers

The next step is to illustrate the high-level technology choices with a Container diagram. A "container" is something like a web application, mobile app, desktop application, database, file system, etc. Essentially, a container is a separately deployable unit that executes code or stores data. The Container diagram shows the high-level shape of the software architecture and how responsibilities are distributed across it. It also shows the major technology choices and how the containers communicate with one another.

Level 3: Components

Next you can zoom in to each container further to visualise the major structural building blocks and their interactions. The Component diagram shows how a container is made up of a number of components, what each of those components are, their responsibilities and the technology/implementation details. If your components don't all fit on a single diagram, create multiple versions showing different portions of the container.

2 The code doesn't tell the whole story. Supplementary documentation can be used to describe what you can't get from the code. Make the scope of the documentation a single software system. Here is a starting point, and there are others including arc42.

Context A system context diagram, plus some narrative text to "set the scene".	Functional Overview An overview of the software system, perhaps including workflows, UI mockups, screenshots, workflow diagrams, business process diagrams, etc.	Quality Attributes A list of the quality attributes (non-functional requirements: e.g. performance, scalability, security, etc).	Constraints A list of the environmental constraints (e.g. timescales, budget, technology, team size/skills, etc).	Principles A list of the development and architecture principles (e.g. coding conventions, separation of concerns, patterns, etc).
Software Architecture A description of the software architecture, including static structure (e.g. containers and components) and dynamic runtime behaviour.	Code A description of important or complicated components, implementation details, patterns, frameworks, etc.	Data Data models, entity relationship diagrams, security, data volumes, archiving strategies, backup strategies, etc.	Infrastructure Architecture A description of the infrastructure available to run the software system.	Deployment The mapping of software (e.g. containers) to infrastructure.
Development Environment A description of how a new developer gets started.	Operation and Support An overview of how the software system is operated, supported, monitored, etc.	Decision Log A log of the major decisions made (e.g. as free format text or a collection of "Architecture Decision Records").	This is a starting point ; add and remove sections as necessary.	

3 A common set of abstractions is more important than a common notation, but do ensure that your notation (shapes, colours, line styles, acronyms, etc) makes sense. If in doubt, add a diagram key/legend, even when using UML.

4 Use the elements in your model of the static structure to create additional supplementary diagrams in order to communicate runtime behaviour and deployment (the mapping of containers to infrastructure).

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12:28 PM - 27 Apr 2017

2 47 99

Software Architecture for Developers

Volume 1

Technical leadership and the balance with agility

Simon Brown

Software Architecture for Developers

Volume 2

Visualise, document and explore your software architecture

Simon Brown



Structurizr

Visualise, document and explore your software architecture

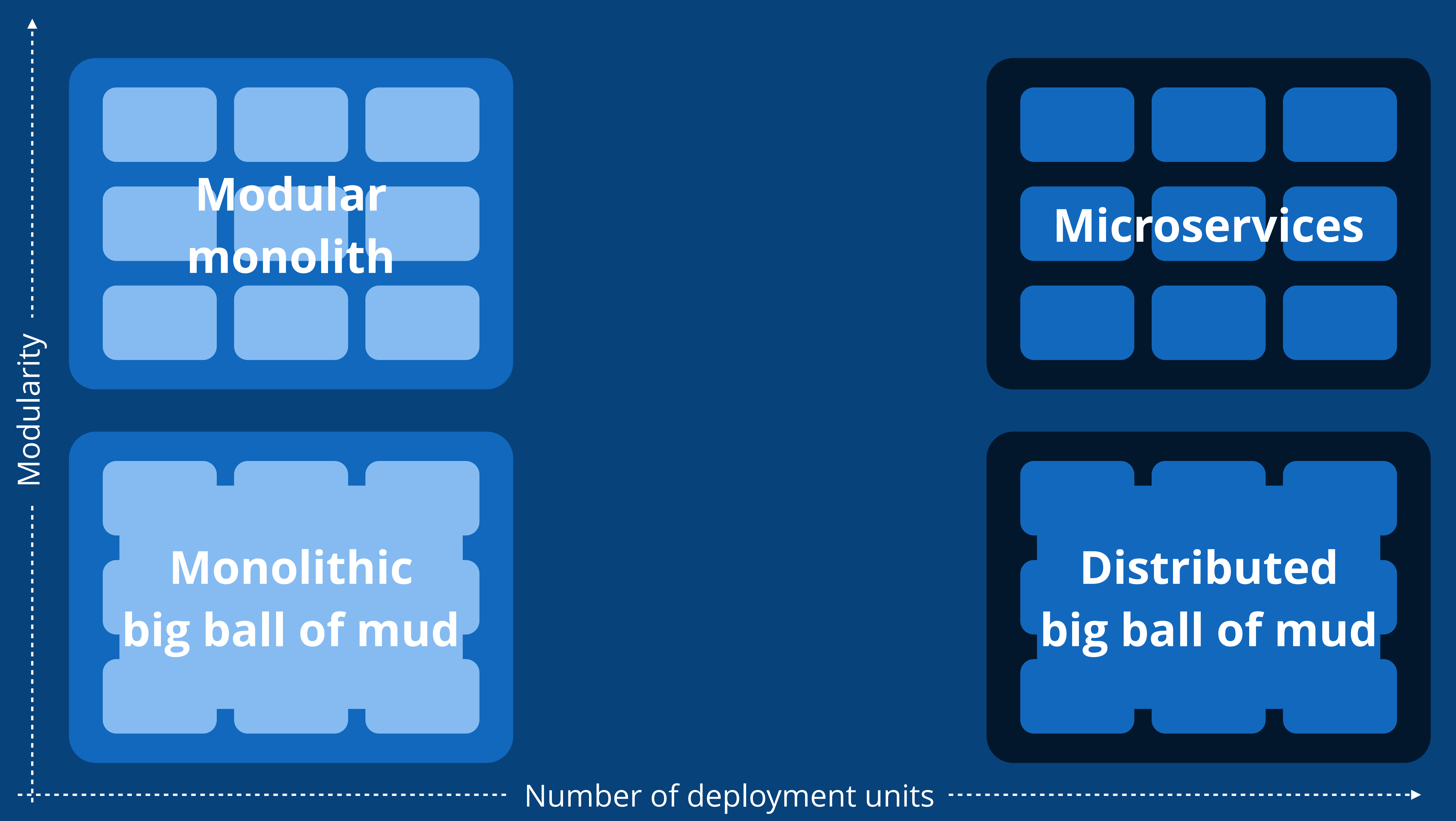
For more information about software architecture diagrams and documentation...

**5. A good software
architecture enables agility**

Agile is about moving fast,
embracing change, releasing often,
getting feedback, ...

Agile is about a mindset of
continuous improvement

A good architecture
enables agility



Agility is a
quality attribute

A good architecture rarely
happens through
architecture-indifferent design



Simon Brown

@simonbrown

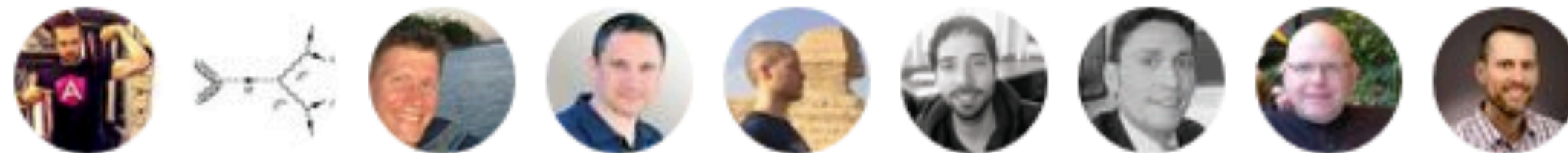
I'll keep saying this ... if people can't build monoliths properly, microservices won't help.
[#qconlondon](#) [#DesignThinking](#) [#Modularity](#)

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258

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10:49 am - 4 Mar 2015



Architect Clippy

@architectclippy

I see you have a poorly structured monolith.
Would you like me to convert it into a poorly
structured set of microservices?

RETWEETS

4,441

LIKES

2,743



12:59 AM - 24 Feb 2015

Five things every developer should know about software architecture

1. Software architecture isn't about big design up front
2. Every software team needs to consider software architecture
3. The software architecture role is about coding, coaching and collaboration
4. You don't need to use UML
5. A good software architecture enables agility

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