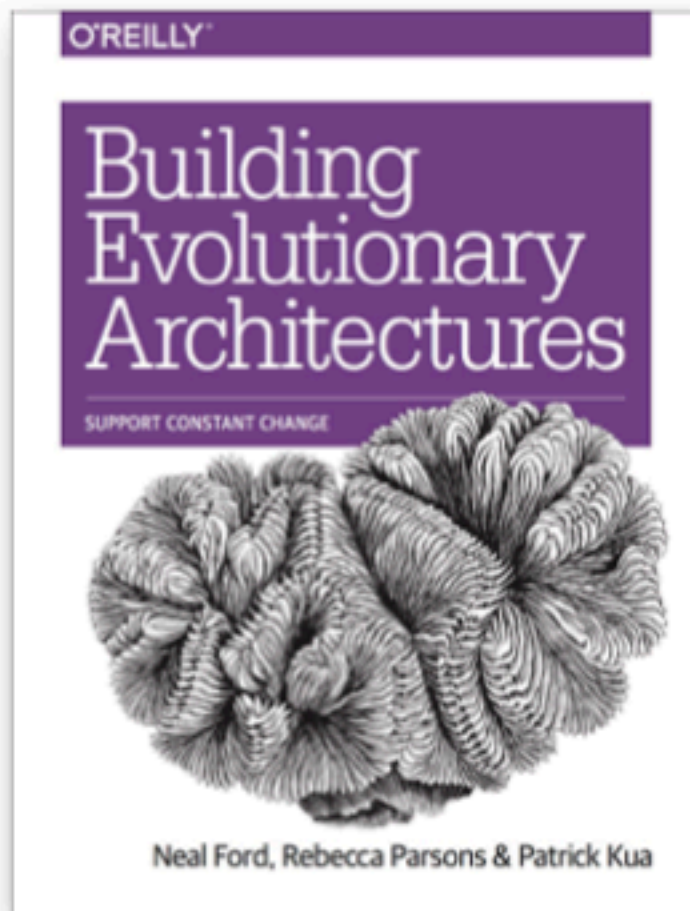# Building Evolutionary Architectures

2-DAY CLASS WORKBOOK

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1. Identify Architectural Characteristics

Make the Grade

A large and populous state would like a new system to support standardized testing across all public school systems grades 3-12.

Requirements: Students will only be able to use the application within testing centers around the state; most of these will be in the schools, and some in contracted testing centers. Once a student starts the test, they can only move forward; either they answer the question, or skip it and move on. The answers and corresponding grades should eventually be consolidated to a single database representing all of the test scores across the state. Tests will be multiple choice and short answer. The system should have a simple reporting capability to know which students have taken the tests and what score they received, and grades aggregated by student, teacher, and school. Short answer questions will be manually graded by teachers, who will then add the short answer grades to the system. Proctors (teachers) will sign students in using their student ID, teacher ID, and school ID (proctors already have this information).

Users: 400,000+ students, 2000 graders, 10 administrators (test creation, test scheduling, etc.)

Additional info:
"Since this is a timed test (teachers time the test, not the system), the system must be very responsive and fast"
"It is **_imperative_** that no student answers are lost in the event of a system crash"
"We would like to install the new system before the start of the next term (6 months)"
"Teachers doing the grading should be able to grade short answer questions and submit grades from home"
"Not all students will be taking the test at the same time. 20,000 at one time may be possible though"

Your Architectural Kata is...

The Road Warrior

A major travel agency wants to build the next generation online trip management dashboard to allow travelers to see all of their existing reservations organized by trip either online of through their mobile device.

Requirements:
The system should use the agency's existing airline, hotel, and car rental interface exchange system to automatically load reservations via frequent flier accounts, hotel point accounts, and car rental rewards accounts. Customers should be able to add existing reservations manually as well. Customers using the dashboard do not need to be customers of the travel agency. Items in the dashboard should be able to be grouped by trip, and once the trip is complete, the items should automatically be removed from the dashboard. Users should also be able to share their trip information by interfacing with standard social media sites. Users should be able to access their trip information anytime day or night.

Projected users: 10,000+ registered users worldwide

Additional Info:
"It is absolutely vital that users be able to access their trip information 24x7"
"We plan on generating lots of business for the agency by creating this dashboard"
"We have currently contracts in place with the central travel exchange system so we can do continuous polling"
"All of the major airlines, hotel, and rental car can be accessed through the exchange"
"Hmm… adding dinner reservations might not be a bad idea after all. Let me ponder that…"

Your Architectural Kata is...

Room With A View

A large hotel reservation company wants to build the next generation hotel reservation and management system specifically tailored to high-end resorts and hotels where guests can view and reserve specific rooms.

Requirements: Registration can be made via web, mobile, phone call, or walk-in. Guests have the ability to either book a type of room (standard, deluxe, or suite) or choose a specific room to stay in by viewing panning pictures of each room and its location in the hotel. The system must be able to maintain room status (booked, available, ready to clean, etc.). It must also have state-of-the-art housekeeping management functionality so that cleaning and maintenance staff can be directed to various rooms based on priority and reservation need using mobile devices attached to the cleaning carts. This will allow rooms to be made available as soon as possible. In addition to the standard reservation functionality (e.g., payments, registration info, check-in, check-out, etc.), the system must also support a reservation system for restaurants and spa located on the resort. The system should be web-based and hosted by the reservation company.

Users: Guests (10,000+); Initial target is 500 hotels and resorts world-wide.

Additional Info:
"Peak season is quickly approaching and our sales folks are already placing orders for the new system"
"We need a way to upload and maintain photos from the hotels and resorts"
"Since each resort and hotel is different, the system must be highly configurable"
"Over time I can see every high-end hotel and resort using this system!"
"We have another team working on the migration from an old system to new, so don't worry about that."

Your Architectural Kata is...

Sysop Squad

An electronics giant needs a new trouble-ticket system for their customer-facing IT consultants (the Sysop Squad) in their stores nationwide

Requirements: trouble tickets can be entered by either call-center receptionists, store staff or customers online; tickets route to the appropriate consultant (most likely already on the road) based on the consultants location, availability and skill; customers enter consultant evaluation after service through email surveys or the website, which will be used to rate the consultant; consultants can access prior work performed in customer records for reference. Customers may get help with computers, stereo equipment, or cable/internet TV's. Customers register and pay for the "sysops squad service plan" once they purchase a product supported by the service.

Users: thousands of customers, hundreds of consultants, hundreds of store staff

Additional Info:
"If a consultant gets five ratings less than 3-stars then they will be fired"
"Consultants should be able to use their own smartphone in the cars"
"We don't have all the requirements yet, so expect a lot of change once the system is in place"
"We need to be able to track where each consultant is at all times so the tickets can be appropriately routed"

1-800-AMI-SICK

Your company wants to build a software system supporting call center nurses (advice nurse) answering questions from customers about potential health problems.

Projected users: 250+ nurses across the country, hundreds of thousands of patients nationwide

Requirements: nurses must be able to access patient medical histories and medical records through an existing electronic records exchange service. The system should assist nurses in providing medical diagnosis via a third-party diagnosis engine and provide nurse followup in some cases. Although stored locally by the system, calls are not part of formal medical history and are not considered electronic medical records. Enable parts of the system for direct client customer use via the internet so customers can leverage the diagnostics engine themselves.

Patients can contact nurses via a call center system or through a chat system via the internet. The call center system and chat system are both part of the scope of this effort. For call center use, patients will need to provide at least 2 forms of positive identification and answer security questions (e.g., who is your current primary care physician, etc.) to verify identity based on their SSN (security information is retrieved through the health care exchange via SSN or current health provider membership number).

Additional Info:

"The *HIPAA Privacy Rule* establishes national standards to protect individuals' medical records and other personal health information and must be taken into account in this system"
"Calls and chats should be routed to the next available nurse, regardless of the location of the call"

Your Architectural Kata is...

Tales Of A Fourth Grade

An education software company wants to build a new web-based comprehensive student management system to be used by elementary schools throughout the U.S.

Requirements: track absences, tardies and excuses (entered by parents, faculty or staff); generate reports on student activities, both in the classroom and in the playground; track student grades and assignments (completed and due); parent-teacher forums. Each school would have their own context (URL) managed by the education company.

Users: faculty, staff and student parents;
Schools using system: 100 initially, 1000's projected

Additional Info:
"We can't have parents seeing information that isn't their own child"
"Parent access should be via web and also via smartphones for certain functionality (absences, forum, activities)"

1. Identify Architectural Characteristics

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— Identify 3-4 primary architectural characteristics

— Identify several secondary architectural characteristics

2. Identify Fitness Functions

2. Identify Fitness Functions

— Identify fitness functions for each primary architectural characteristic

— Identify fitness functions for some secondary architectural characteristics

— rank fitness functions by difficulty to implement (e.g., time, effort, complexity, knowledge, ...)

3. Fitness Function Katas

Penultimate fitness function:

Configure Some of the Things All of the Time

PenultimateWidgets has been burned in the past by having hard-coded constants in several places in their code base, governing both business cases (thresholds, maximums, etc.) and operational concerns. Architects need a way to prevent developers from accidentally hard-coding critical values.

Penultimate fitness function:

Audit the Accounting

PenultimateWidgets has been a Bad Company (cheating on some complex accounting rules), but they have reformed their ways and paid their penalties. Now, however, as part of the settlement, they agree to put auditing measures in place around code that handles accounting rules. State auditors come once a quarter to look everything over, but PenultimateWidgets has found it too much of a chore to delay preparation until near audit time; they want a more automated way to verify things.

Penultima↑e fitness function:

Replace the Crufty Core

PenultimateWidgets built a network scanning tool many, many years ago to look for suspicious activity at the network packet level. To achieve the proper performance, the code was written and has been maintained in increasingly complex C code. PenultimateWidgets needs to replace the code but is nervous about introducing bugs and/or harming performance or throughput.

Penultima↑e fitness function:

Discover All The Things

PenultimateWidgets publishes an API for third-party, business-to-business integrations. To make it easier for clients to consume their services, they have instituted a convention that every endpoint delivers a documentation string when called with the additional parameter '&docs=true'. PenultimateWidgets architects want to ensure that all published endpoints include this documentation string.

Penultima↑e fitness function:
Zero Day Security Check

PenultimateWidgets management has become concerned about zero-day exploits in open source libraries and has tasked the security team with coming up with a way of ensuring that projects do not use known compromised versions.

Penultima⬆e fitness function:
A11y All the Things

PenultimateWidgets has decided that all new development of user interfaces must support accessibility, both web and desktop.

Penultima↑e fitness function:

Deterministic Distributability

PenultimateWidgets has been burned in the past by hard-coded strings in applications that tie applications to a particular data center location. They want to ensure this doesn't happen in the future.

Penultima↑e fitness function:

DireDeltas

PenultimateWidgets developers have developed a bad habit of keeping files checked out for days or weeks at a time, preventing continuous integration. As part of their attempt to improve engineering practices overall, the enterprise architects at PenultimateWidgets encourage frequent check-ins with corresponding good test coverage.

4. Identify Number of Quanta
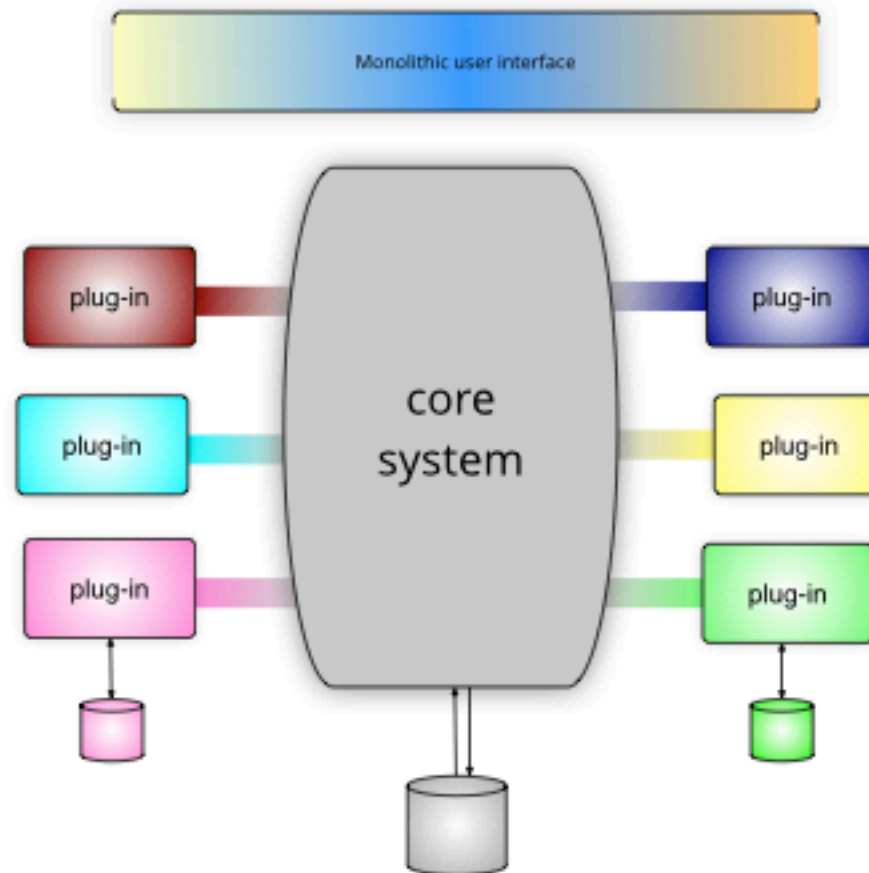
Legend:

Solid lines => synchronous and/or pseudo) transactional access

Dotted lines => eventually consistent, always asynchronous
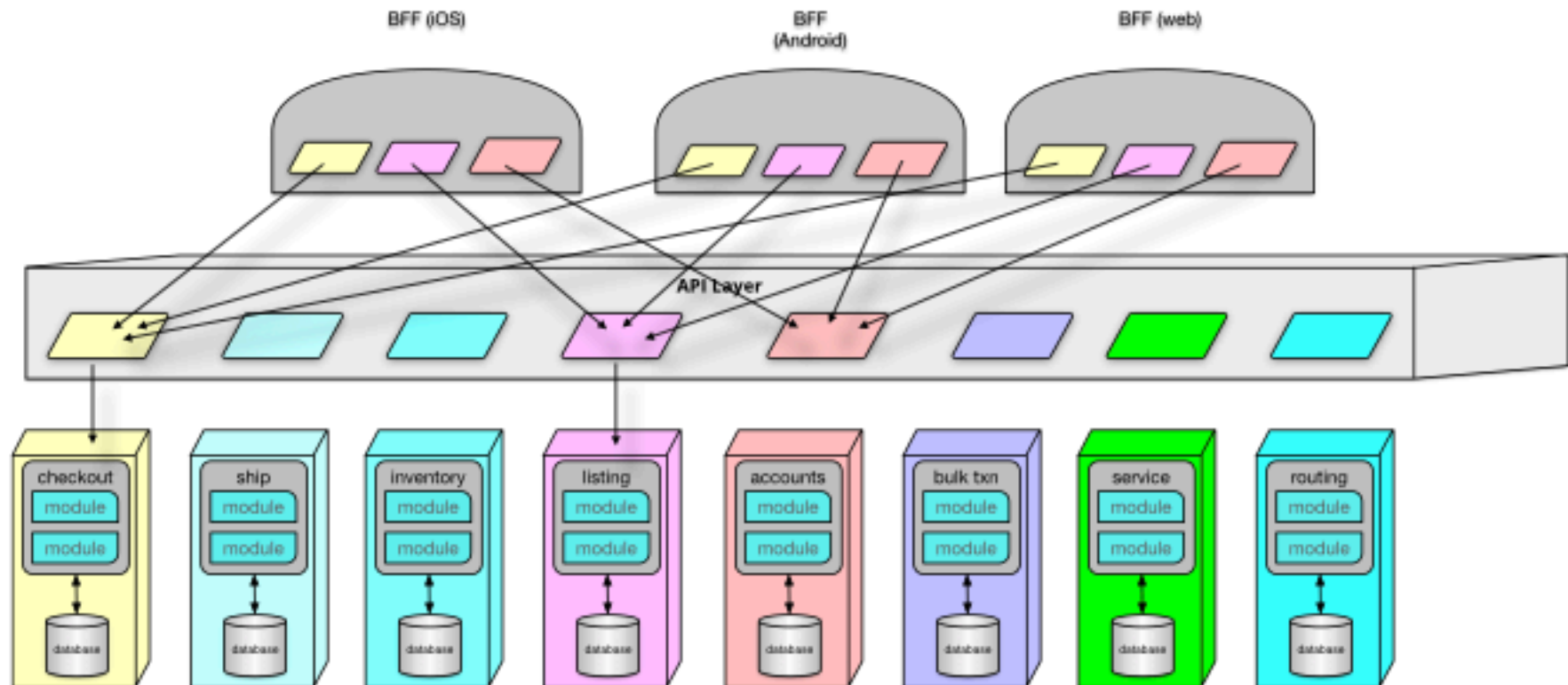
I. Microkernel w/ shared database
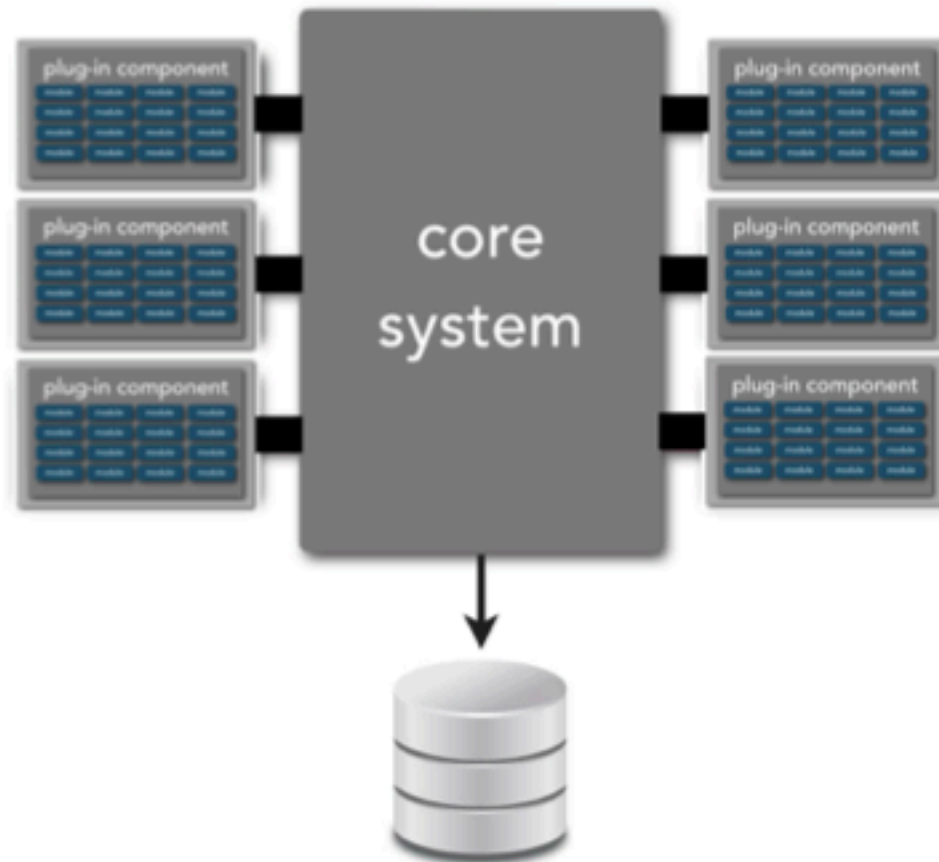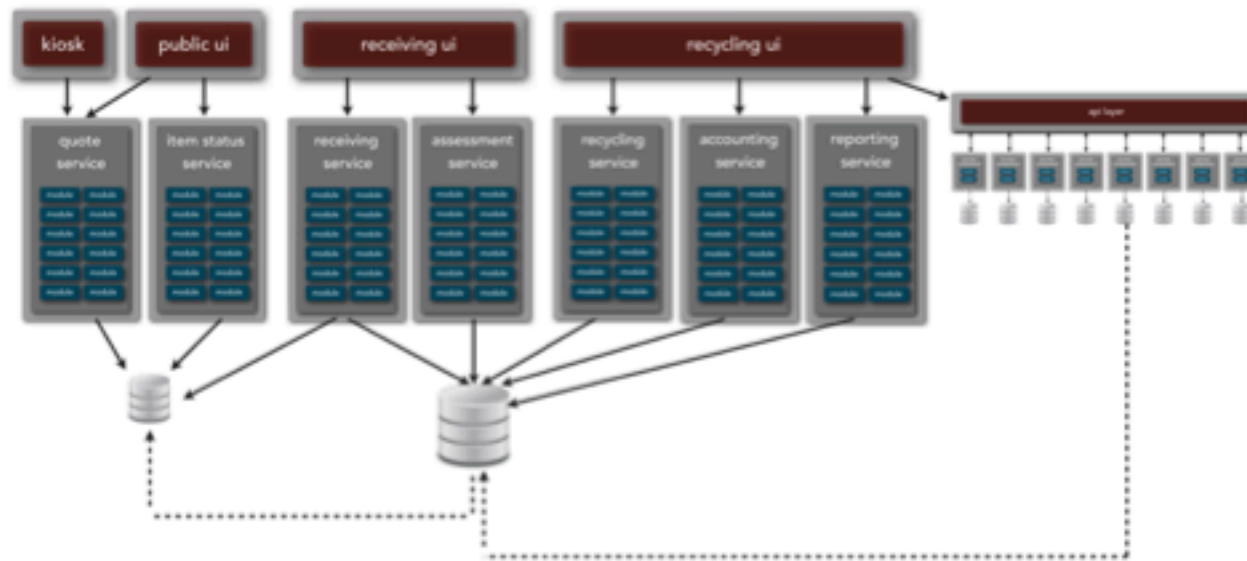
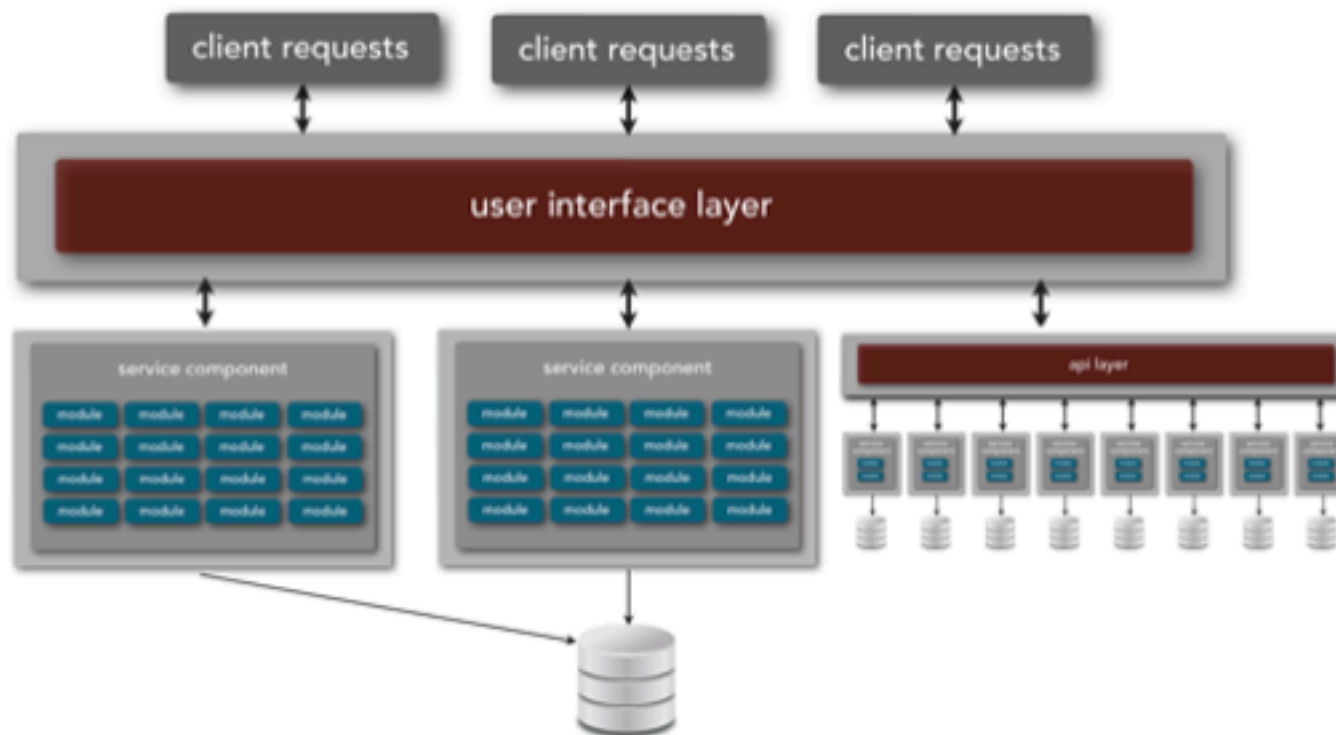# II. Microkernel w/ independent databases

III. Microservices:BFF Pattern

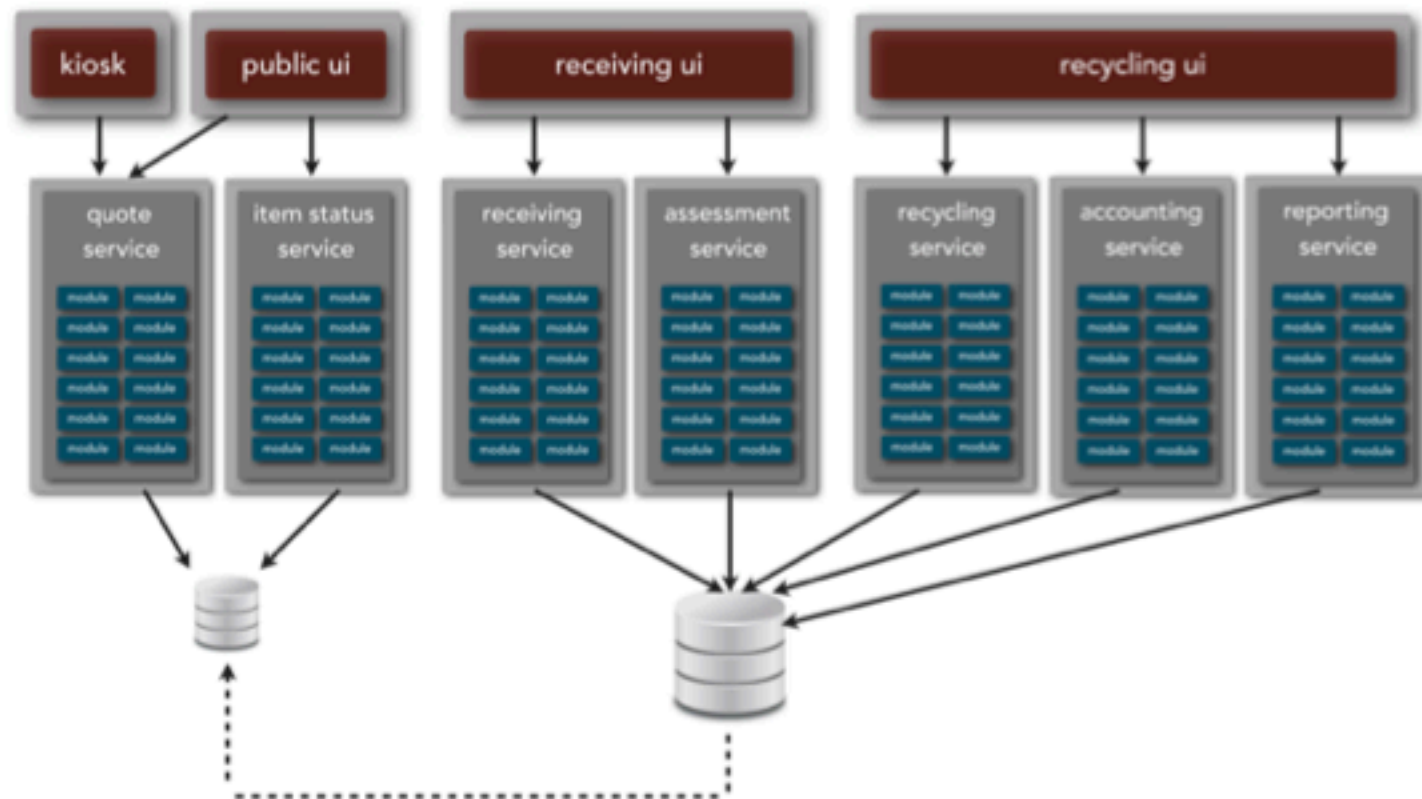https://samnewman.io/patterns/architectural/bff/

IV. Complex Hybrid

V. Complex Hybrid 2

VI. Complex Hybrid 3

5. Identify Quanta for Your Solution