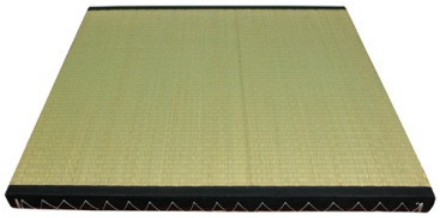
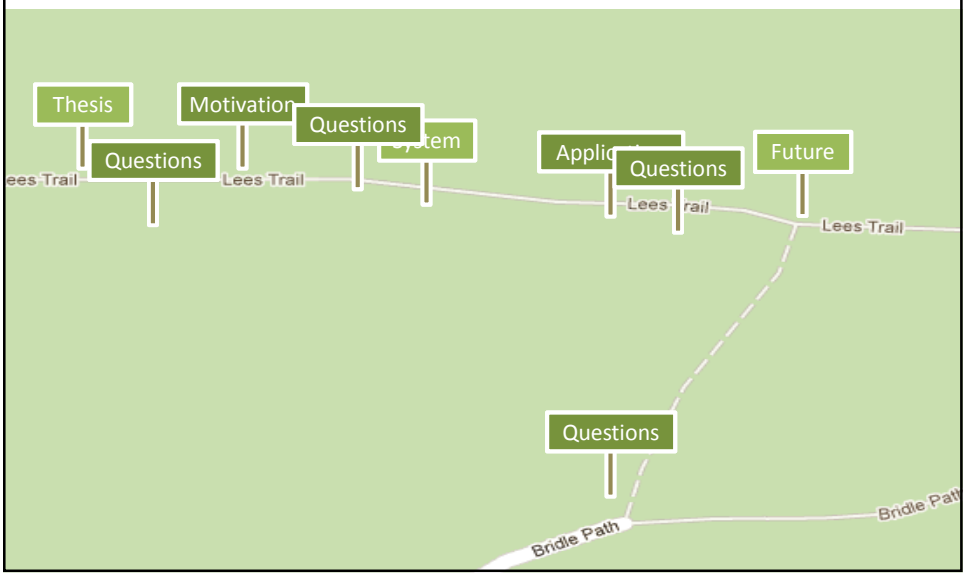
TaTAMi



Taint
Tracking for
Application
Migration

MSc Research Presentation, Lee Beckman

Outline



Thesis

Application + Taint Tracking -> Guidelines for Migrating Application

Taint Tracking: Tag application data to monitor how it flows through application.
- -Composition
- -Modification
- -Persistence
- -Typically used in security

Migration: Deploying application in changed environment to meet growing demands.
- -Locally
- -Cloud
- -Hybrid

Motivation

Needs of Applications

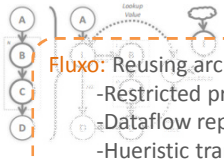
Demands are placed on an application, requiring change.
- -Large, poorly understood, need guidance
- -Difficult to know what changes are, safe, optimal
- -Estimate use of resources
- -Automated analysis needed

Ex: LinkedIn, MySpace, and Flickr
- -Major architectural revisions to keep up with growing demand.
- -Expensive
- -Using Understood Patterns

Research already exists to this end
- -Room for improvement…

Motivation

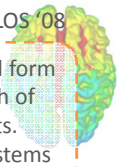
Motivating Research



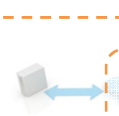
MSR, SoCC '10

Fluxo: Reusing architectural patterns
- -Restricted programming model
- -Dataflow representation
- -Hueristic transformations
  - -Caching
  - -Pre/Post-computation
  - -Tiering (stateless vs stateful)

UC, ASPLOS '08

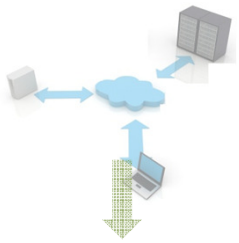


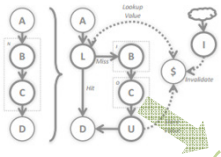
Dataflow Tomography: Advanced form of taint tracking, track entire path of data, not just start and end points.
- -For understanding large systems
- -Easier to understand then CFGs
- -Low-level, semantics difficult
- -In need of uses

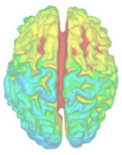


Application Partitioning: Physically splitting an application up.
- -Original motivator
- -Focus on:
  - -Graph cutting
  - -Execution time, communication bandwidth
- -Hybrid cloud deployments
- -Need to handle state

Motivation

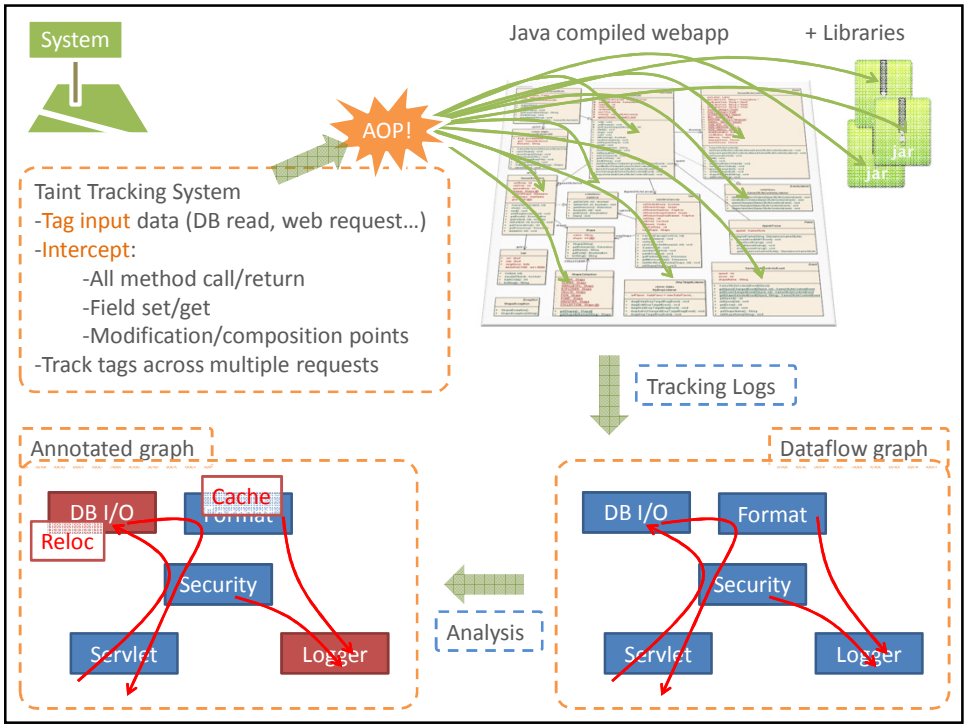


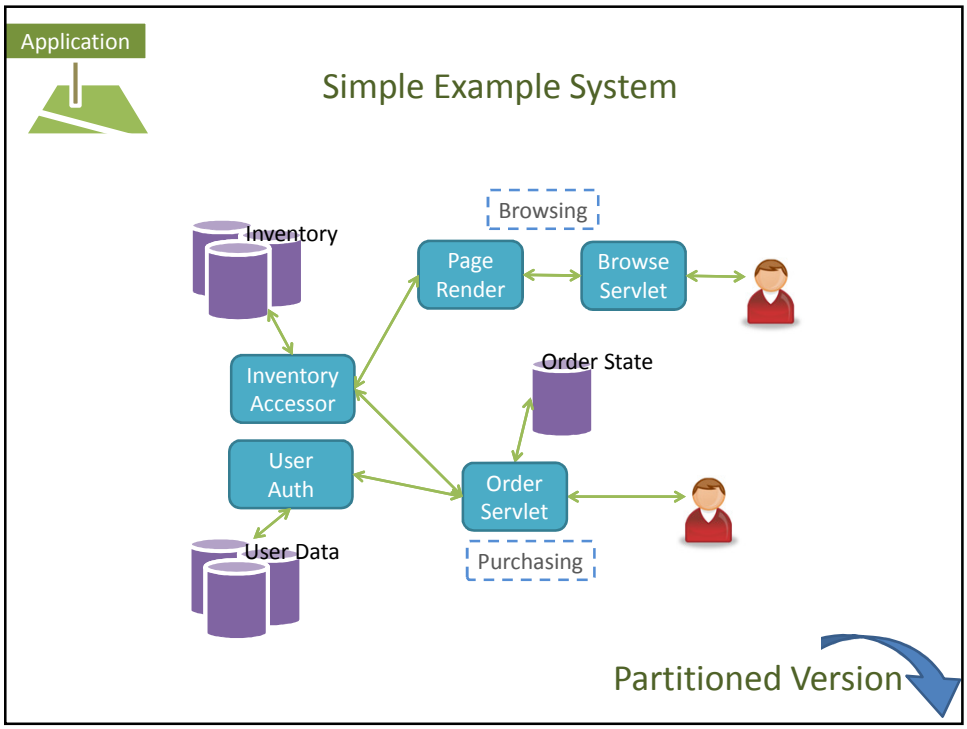


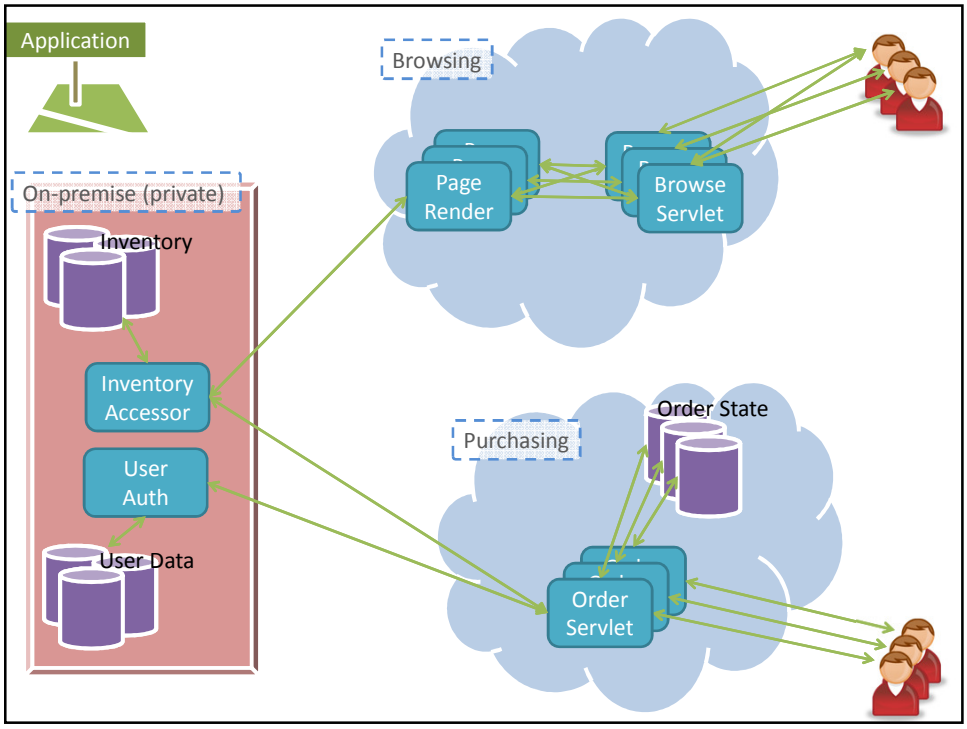


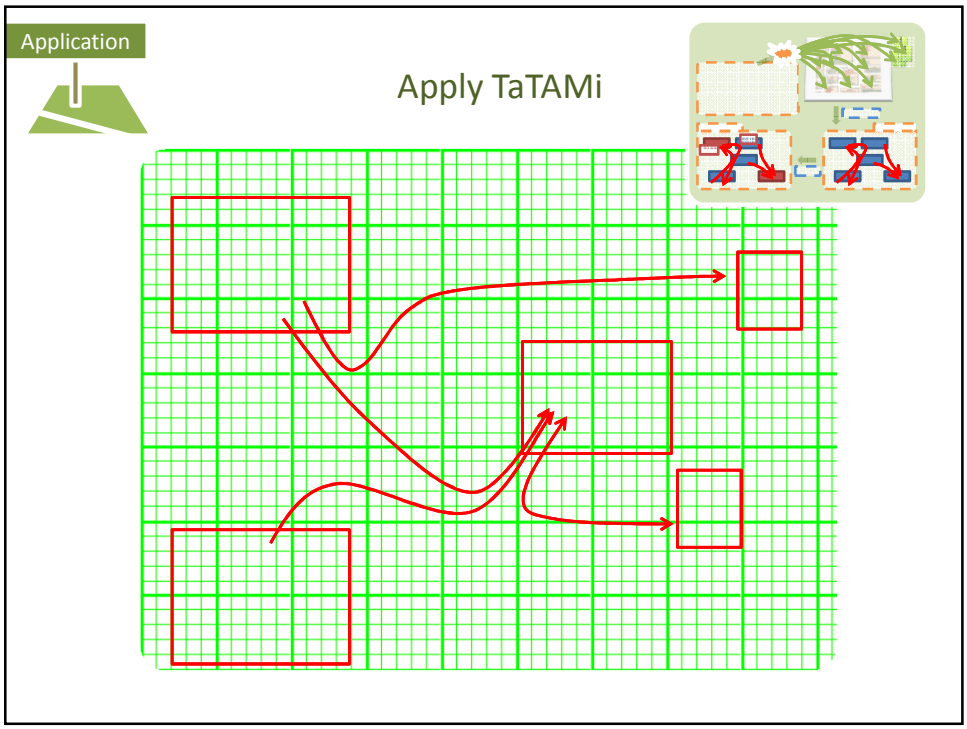
-Fluxo limited by restricted programming model
-Dataflow Tomography seeking uses
-Problems such as partitioning need more data
…

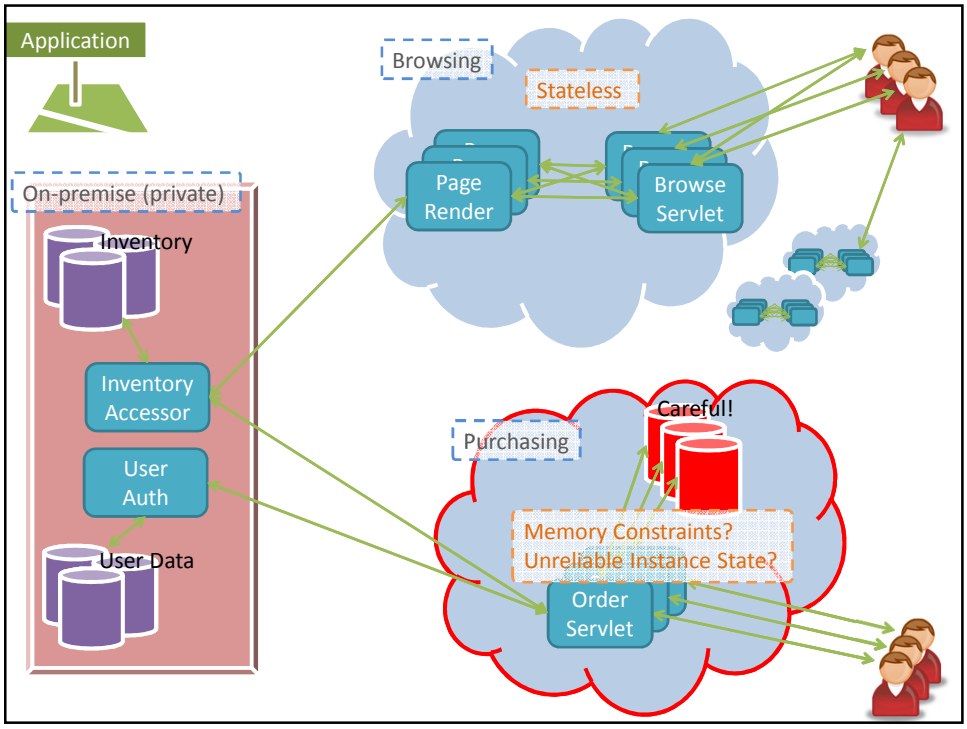
Use Tomography to produce Fluxo-like Dataflow representation.
Apply Fluxo-style optimizations
Provide data useful to partitioners, etc

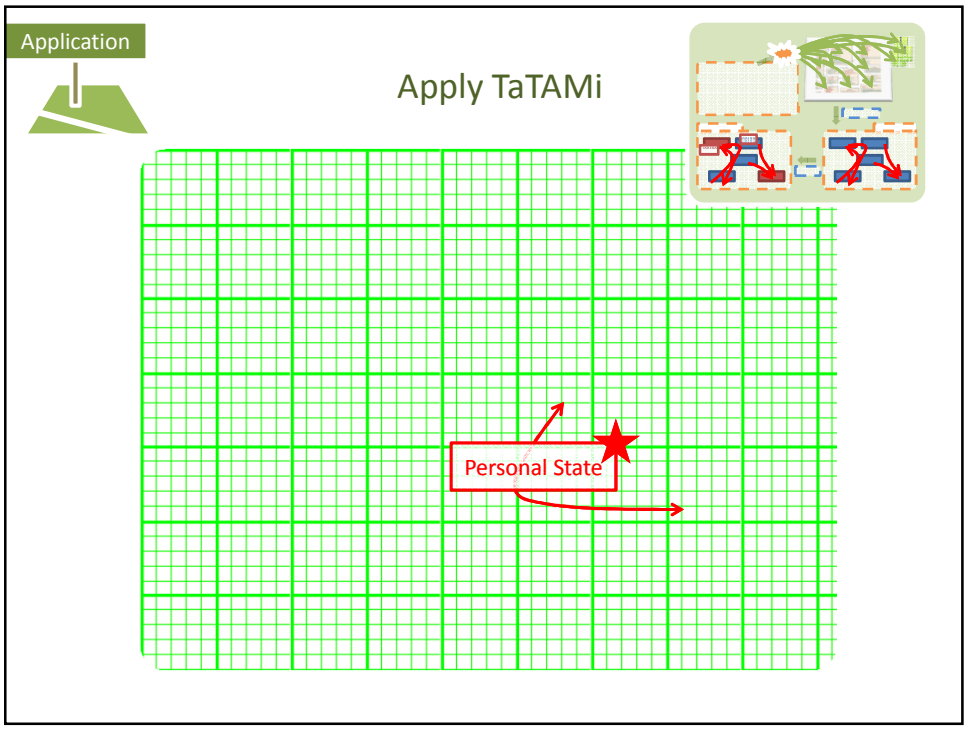

System
Java compiled webapp
+ Libraries
AOP!
Taint Tracking System
-Tag input data (DB read, web request…)
-Intercept:
-All method call/return
-Field set/get
-Modification/composition points
-Track tags across multiple requests
Tracking Logs
Annotated graph
Dataflow graph
DB I/O
Cache
Reloc
Security
Servlet
Logger
Format
Analysis

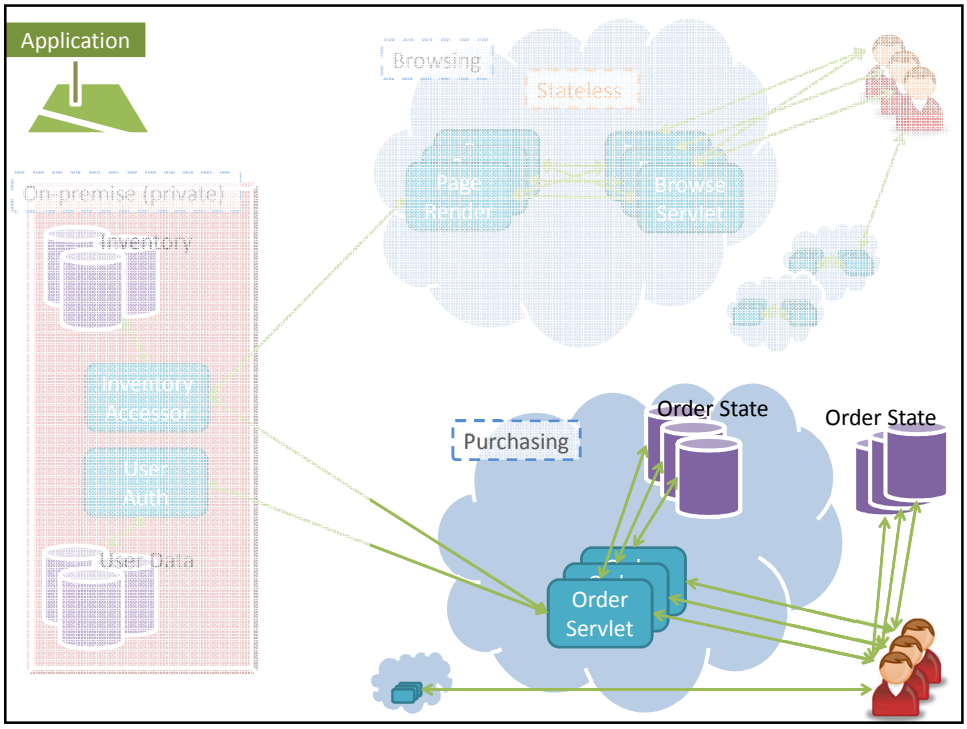

Application
Simple Example System
Browsing
Inventory
Page Render
Browse Servlet
Inventory Accessor
Order State
User Auth
Order Servlet
User Data
Purchasing
Partitioned Version

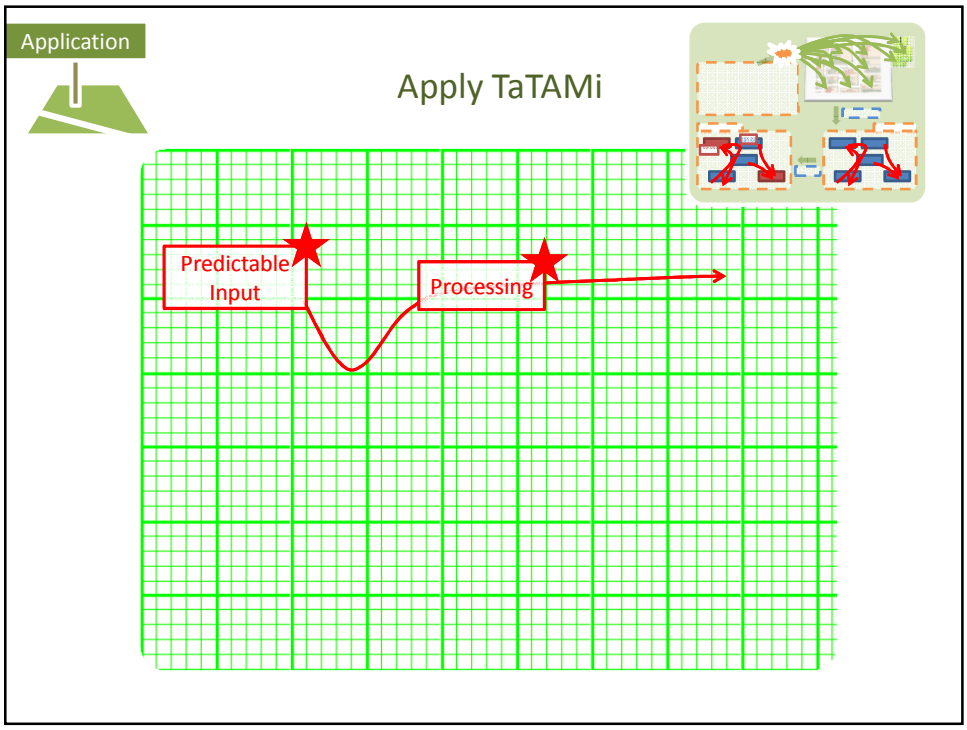

Application
Browsing
Page Render
Browse Servlet
On-premise (private)
Inventory
Inventory Accessor
User Auth
User Data
Purchasing
Order State
Order Servlet

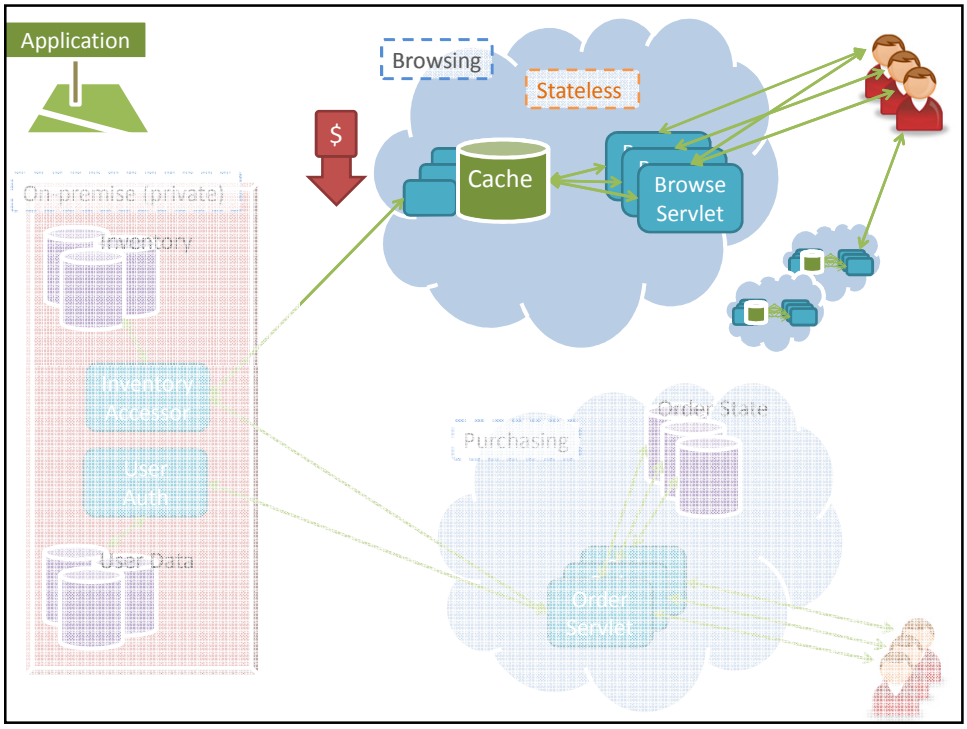

Application
Apply TaTAMi

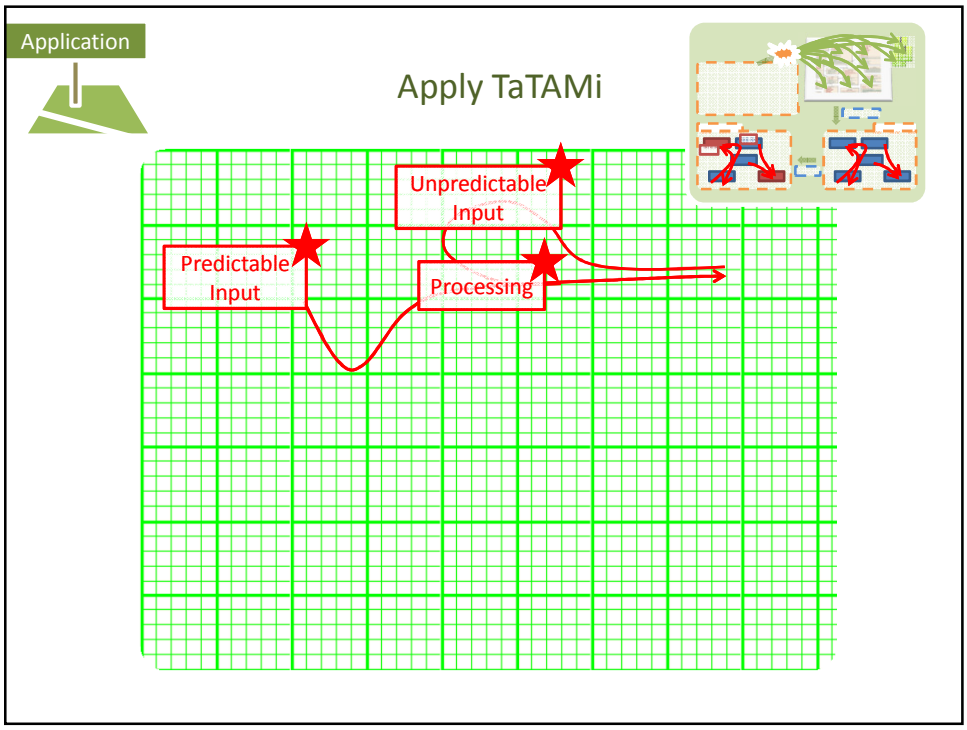

Application
Browsing
Stateless
Page Render
Browse Servlet
On-premise (private)
Inventory
Inventory Accessor
User Auth
User Data
Careful!
Purchasing
Memory Constraints?
Unreliable Instance State?
Order Servlet

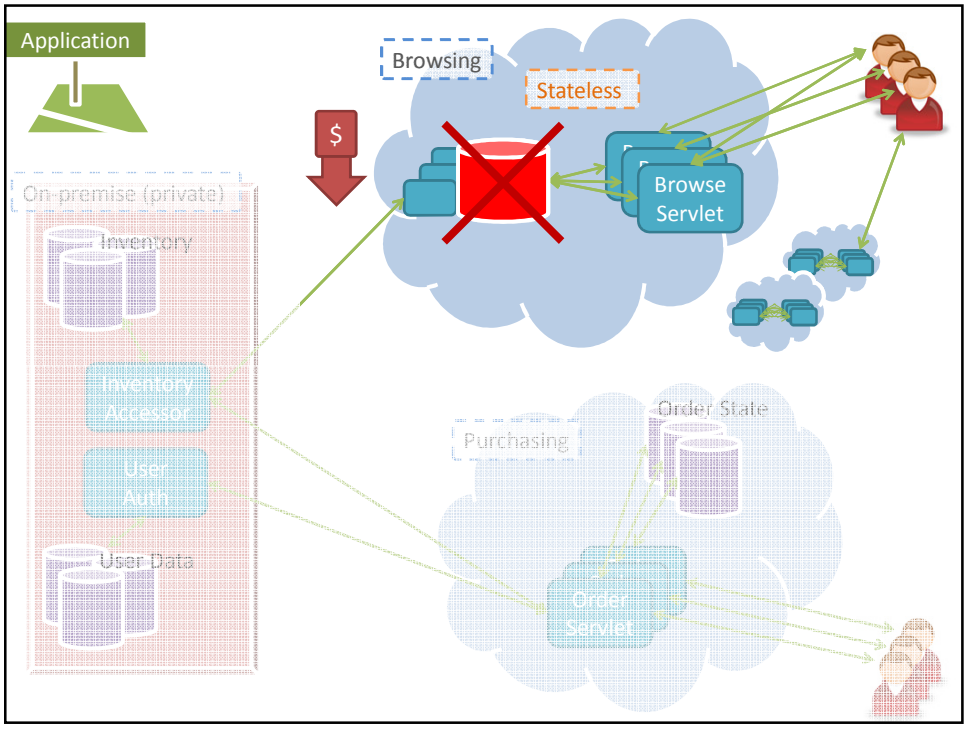

Application
Apply TaTAMi
Personal State

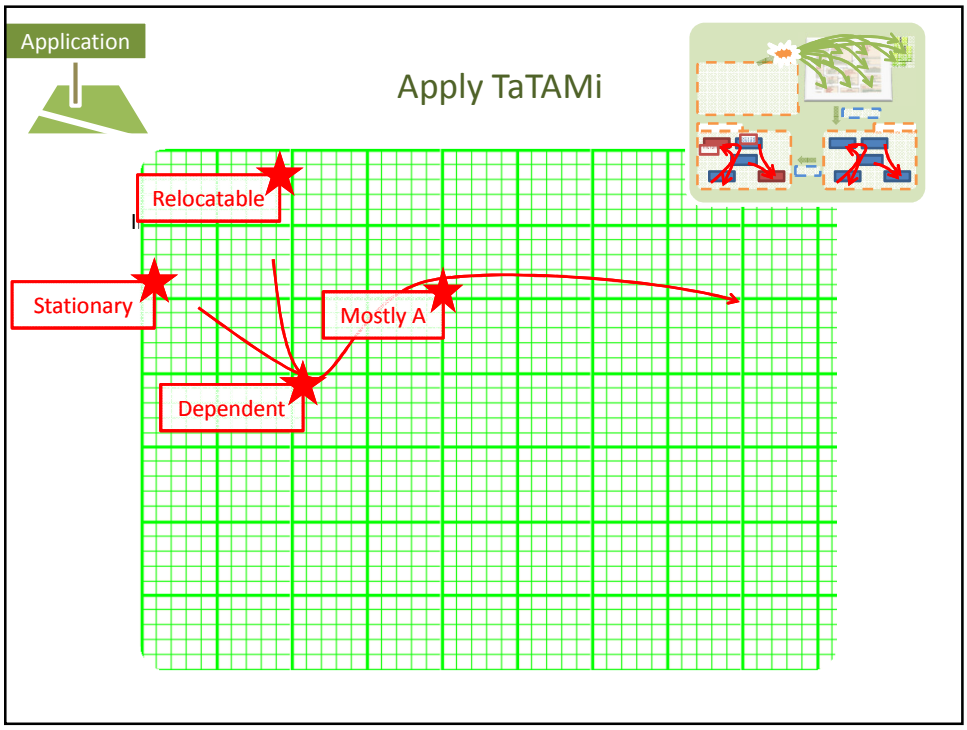

Application
Browsing
Stateless
Page Renderer
Browse Servlet
On-premise (private)
Inventory
Inventory Accessor
User Auth
User Data
Purchasing
Order State
Order State
Order Servlet

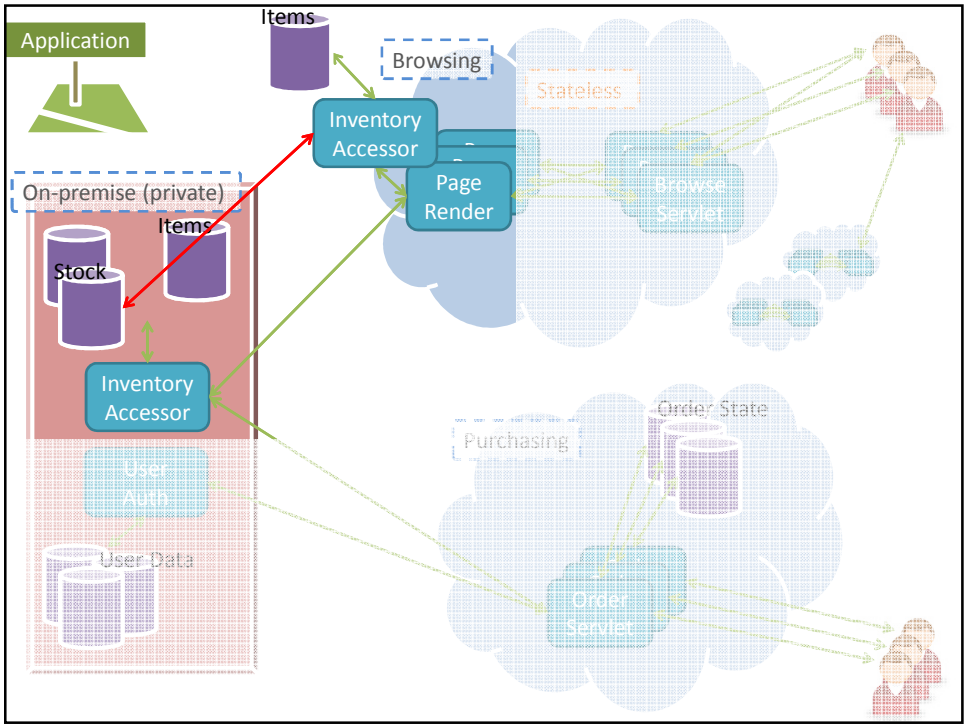

Application
Apply TaTAMi
Predictable Input
Processing

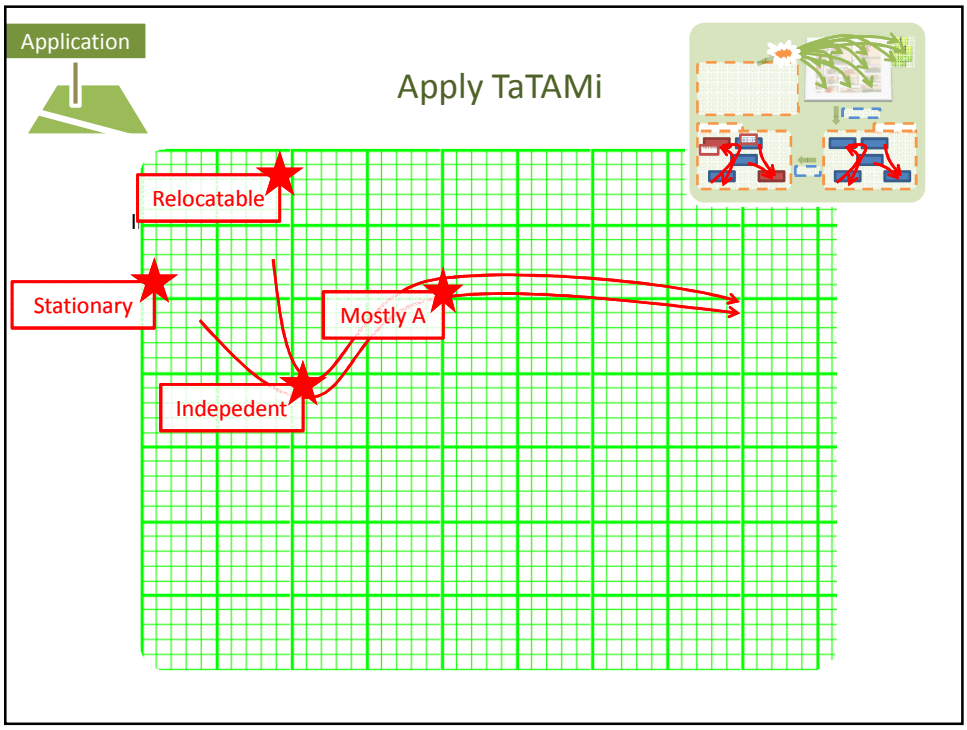

Application
Browsing
Stateless
$
Cache
Browse Servlet
On-premise (private)
Inventory
Inventory Accessor
User Auth
User Data
Purchasing
Order State
Order Service

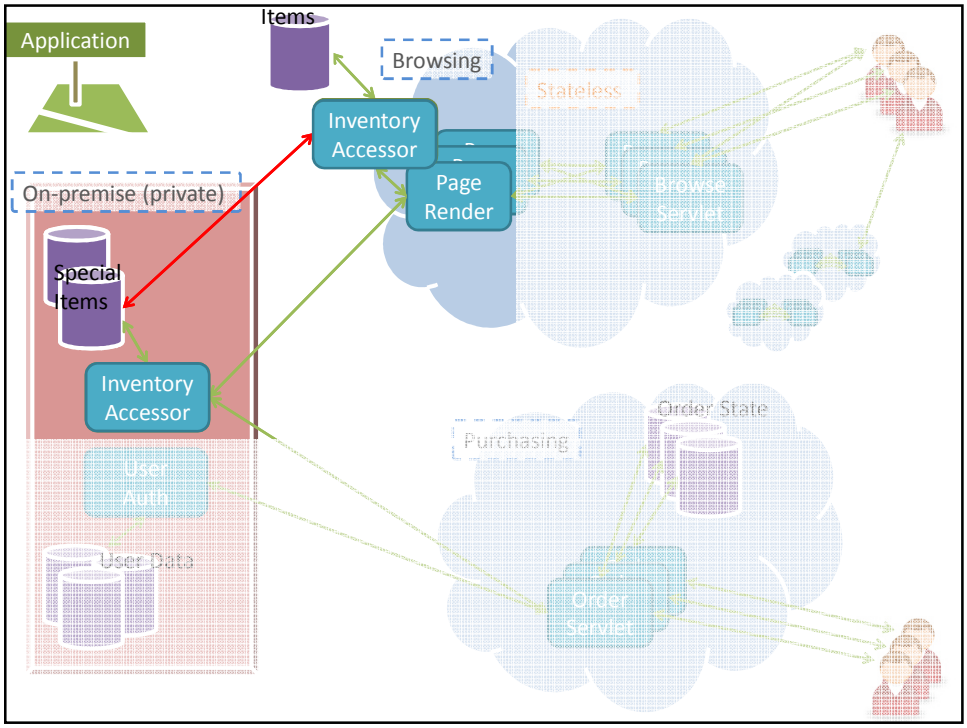

Application
Apply TaTAMi
Unpredictable Input
Predictable Input
Processing


Application
Browsing
Stateless
$
Browse Servlet
On-premise (private)
Inventory
Inventory Accessor
User Auth
User Data
Purchasing
Order State
Order Servlet

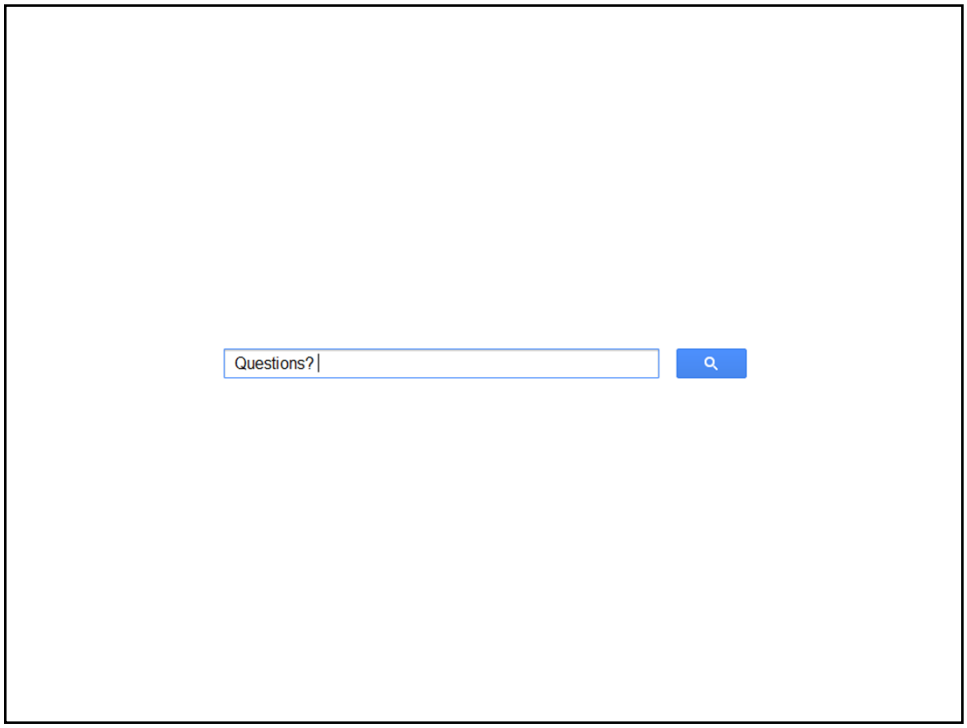

Application
Apply TaTAMi
Relocatable
Stationary
Mostly A
Dependent


Application
Items
Browsing
Stateless
Inventory Accessor
Page Render
On-premise (private)
Items
Stock
Inventory Accessor
Purchasing
Order State


Application
Apply TaTAMi
Relocatable
Stationary
Mostly A
Indepedent


Application
Items
Browsing
Stateless
Inventory Accessor
Page Render
On-premise (private)
Special Items
Inventory Accessor
User Auth
User Data
Purchasing
Order State

Future
Making sense of the data
-Visualization
-Analysis code
Evaluation
-Toy applications
-Optimizing a real application
Integration
-Nima's tool
TO DO
ALL DONE


Questions?