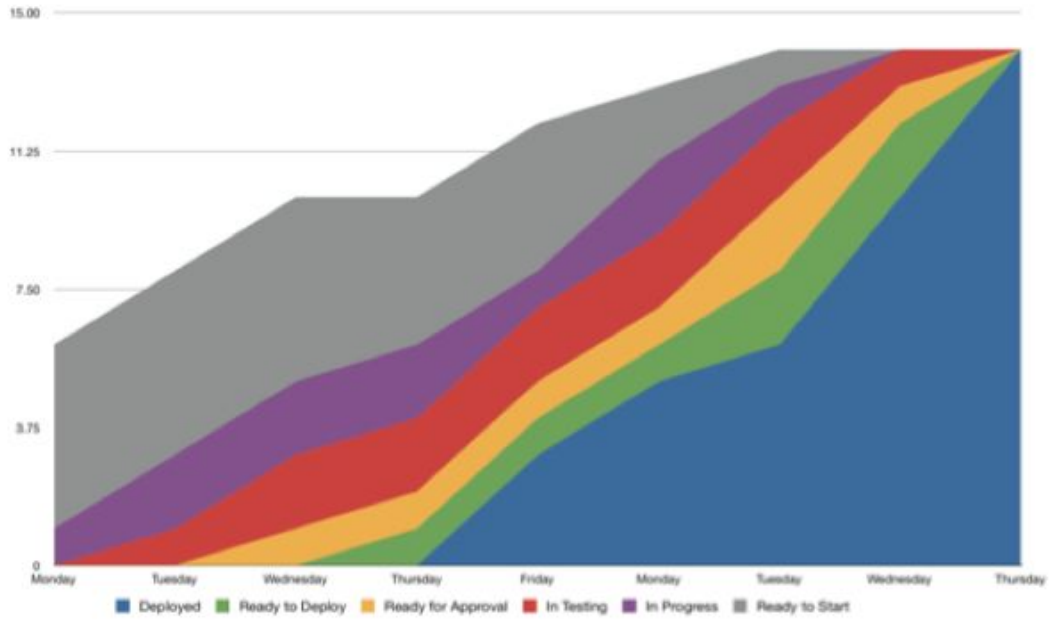
Cumulative Flow Diagram Analysis

Anthony Panozzo

Overview

- Queues
- Little’s Law
- Work in process
- Cumulative Flow Diagrams



What is a queueing system?

A queuing system is a system that can be modeled as consisting of discrete items which arrive at a certain rate, receive service, and then depart.

Examples:

- grocery stores
- grocery lines
- factory production
- coordinator workflow
- software development
- internet packet switching

What is Little’s Law?

A property of queueing systems, John Little

$$L = \lambda W$$

L = average number of customers in the system

λ = average arrival rate

W = average time a customer spends in the system

Applications of Little's Law

$$L = \lambda W$$

L = average number of customers in the system

λ = average arrival rate

W = average time a customer spends in the system

If 10 people arrive to the store each hour and take 0.5 hour each to leave, on average there are 5 people in the store at any given time.

Applications of Little's Law

$$L = \lambda W$$

L = average number of customers in the system

λ = average arrival rate

W = average time a customer spends in the system

If 100 people arrive to the checkout line each hour and take 3 minutes each, on average there are 5 people in line at any given time.

Applications of Little's Law

$$L = \lambda W$$

L = average number of customers in the system

λ = average arrival rate

W = average time a customer spends in the system

If there are on average 2 customers in the checkout line and 10 customers appear each hour, then customers must be spending 0.2 hours on average checking out.

Another look at Little's Law

$$L = \lambda W$$

L = average number of customers in the system

λ = average arrival rate

W = average time a customer spends in the system

What happens if the parameters go up?

What happens if the parameters go down?

What is work in process (WIP)?

- Things started, not finished
- TPS
- Applies to knowledge work too

Seems familiar...

WIP = Throughput * Cycle Time

WIP = average number of items in process (L)

Throughput = average *departure* rate = (λ)

Cycle Time = average time an item spends in the system = (W)

How can we reduce cycle time so that customers get value faster?

Seems familiar...

Cycle Time = Throughput / WIP

WIP = average number of items in process (L)

Throughput = average *departure* rate = (λ)

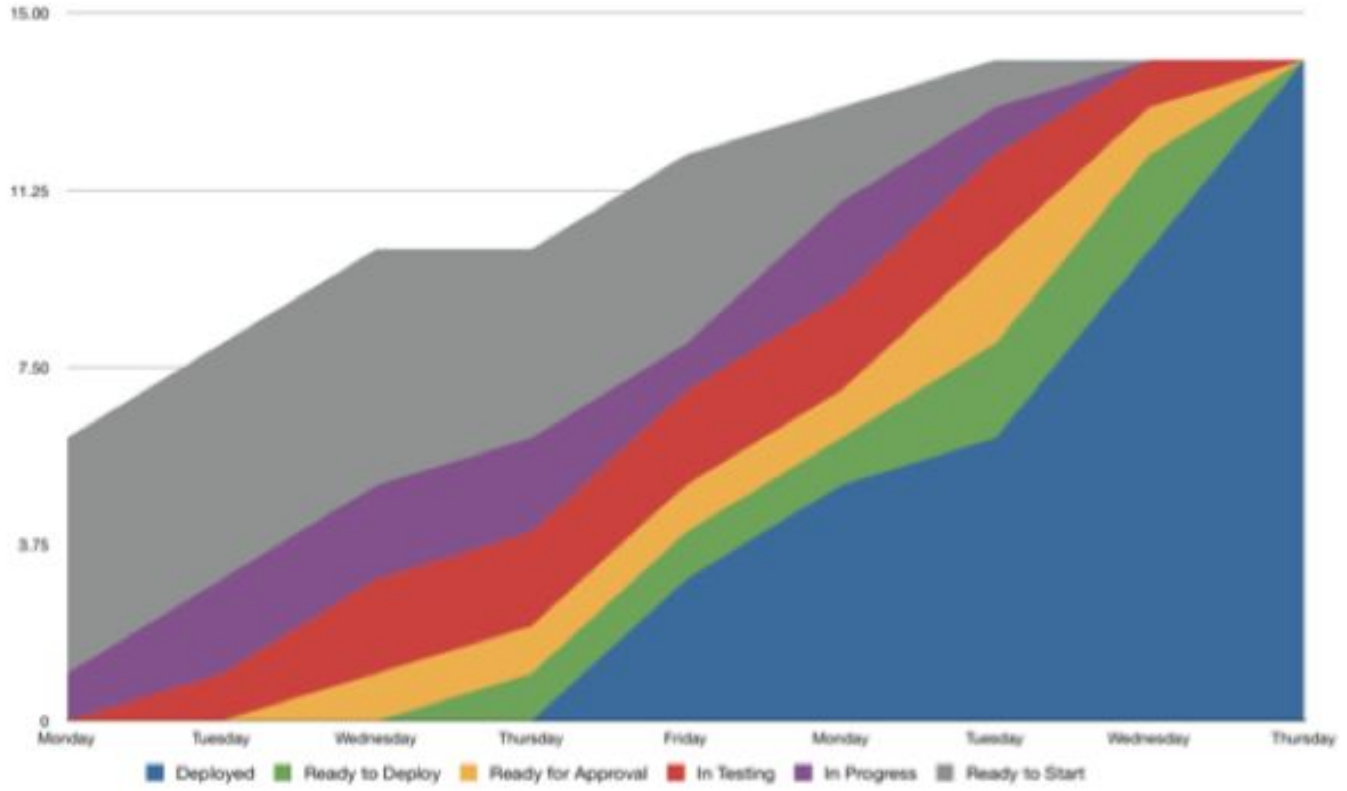
Cycle Time = average time an item spends in the system = (W)

How can we reduce cycle time? Increase throughput or reduce WIP

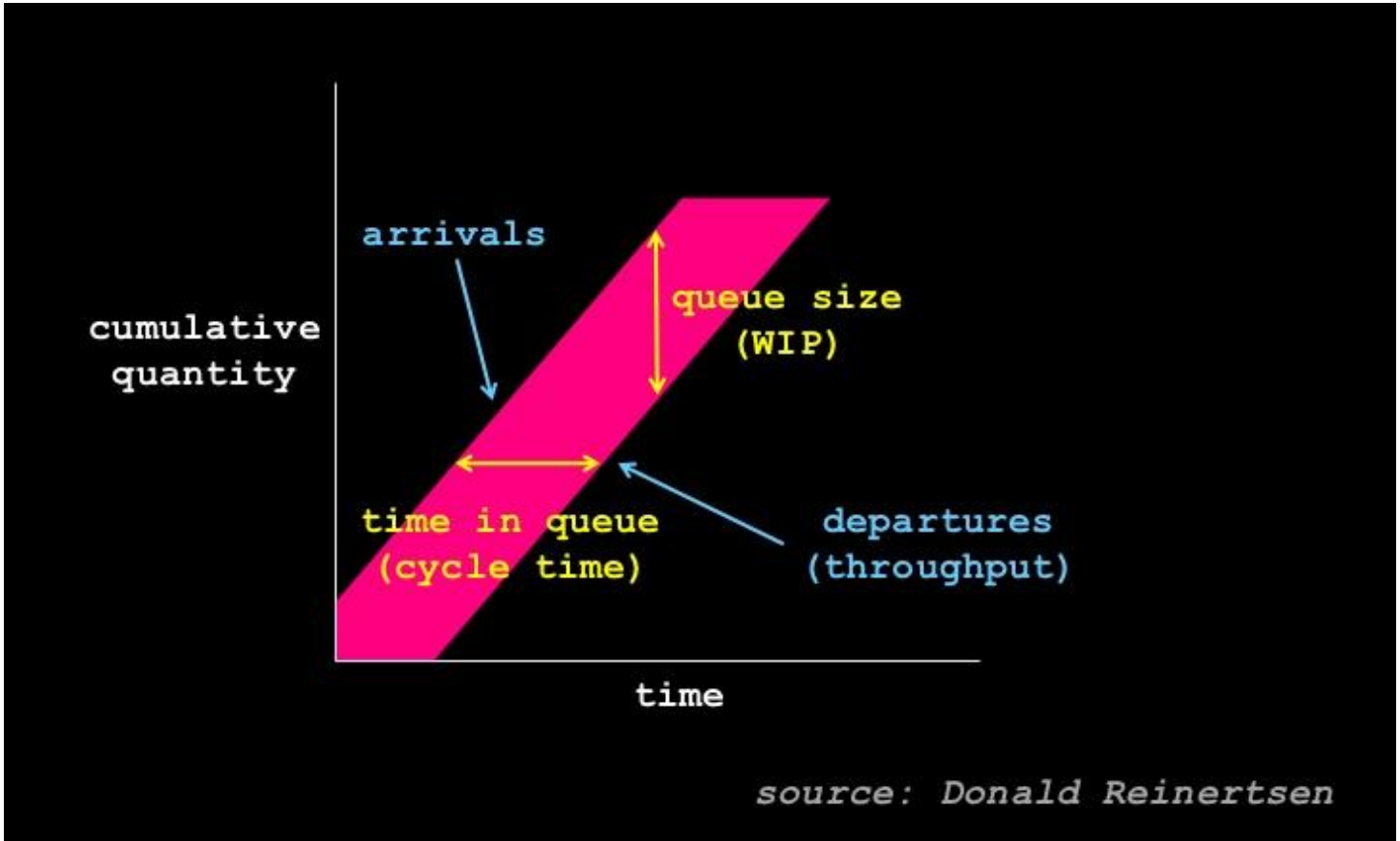
Why do we want to reduce work in process?

- Reduces queues, which gives us:
  - Faster time to deliver value
  - Increased motivation
  - Surface quality problems faster
  - Less likely to have the world change
  - Reduce variability in how long it takes us to deliver value

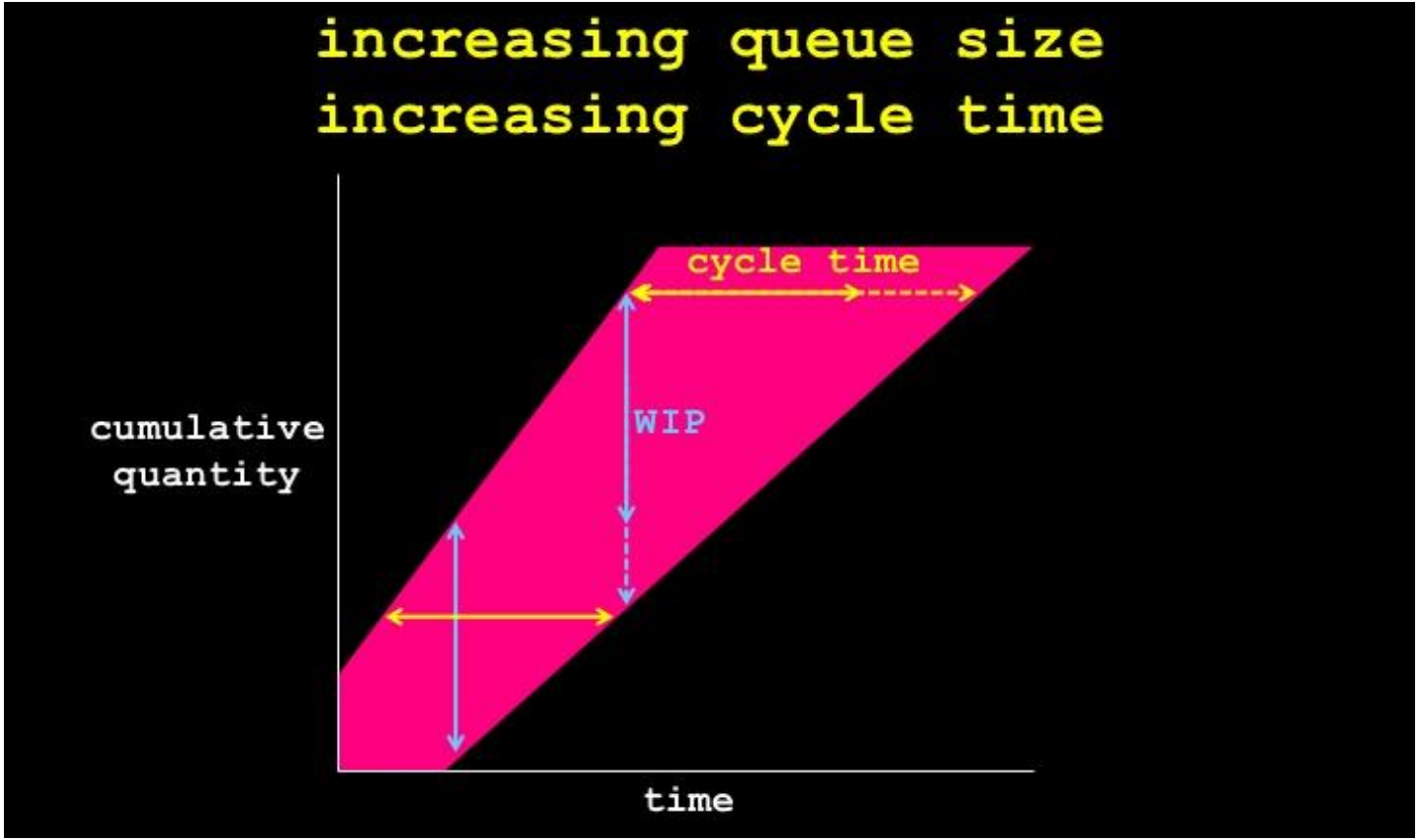
What are cumulative flow diagrams?



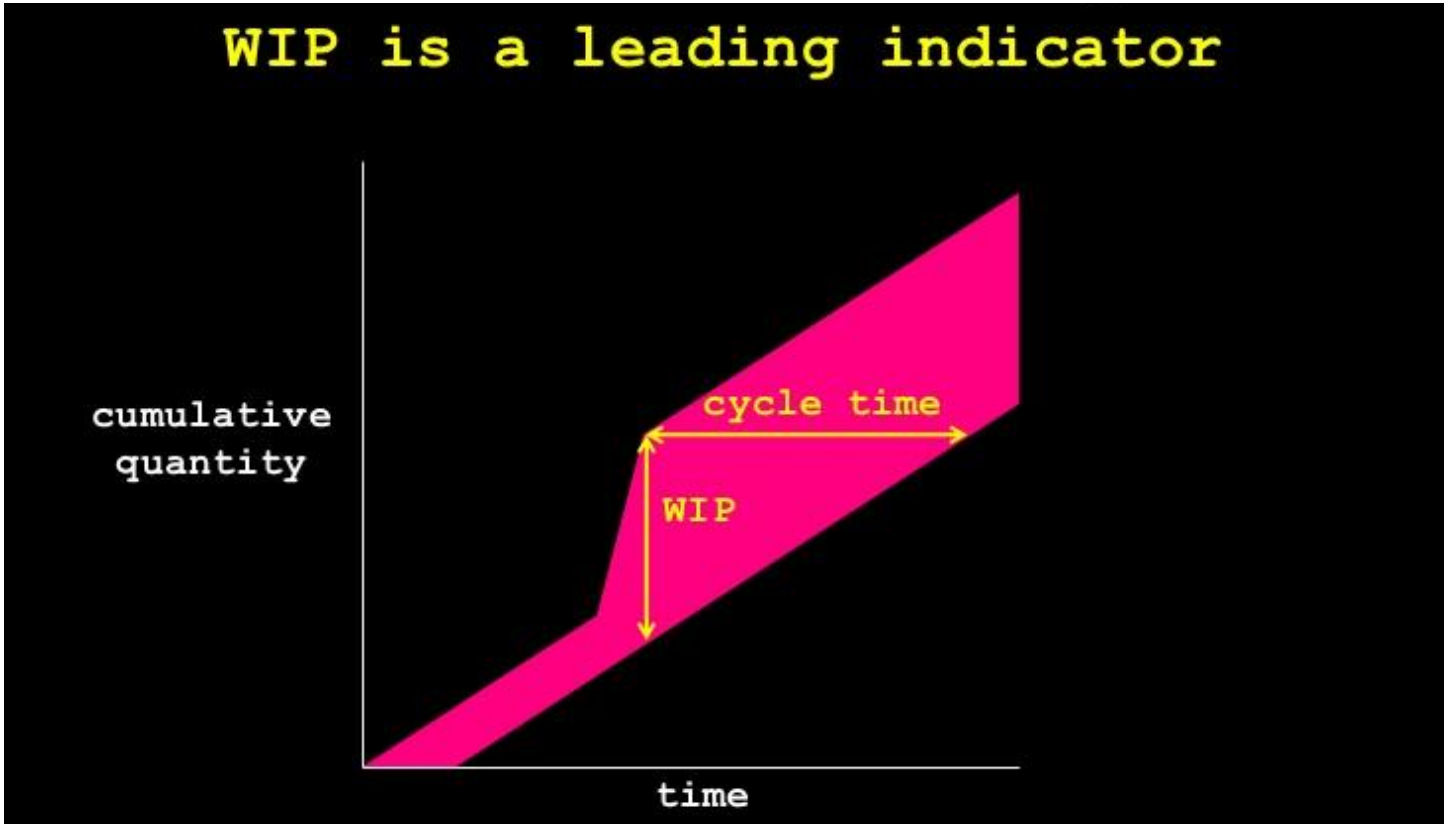
Interpreting CFD slices



Interpreting CFD slices

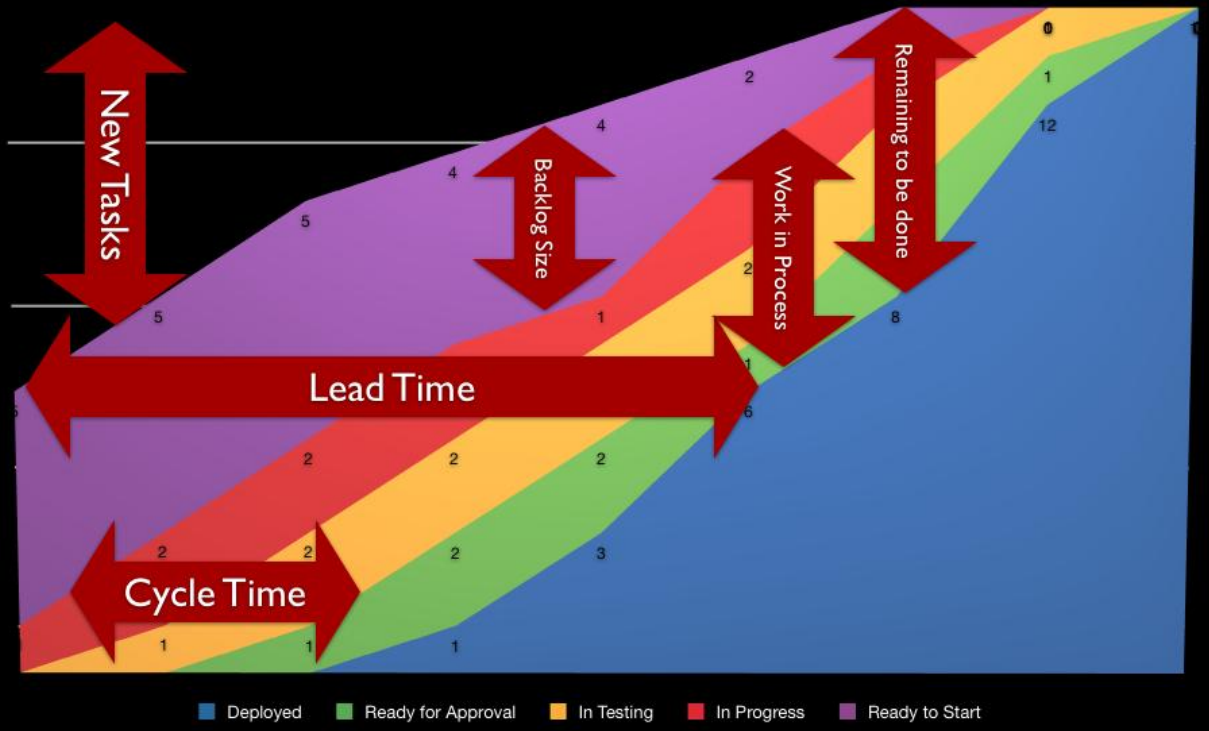


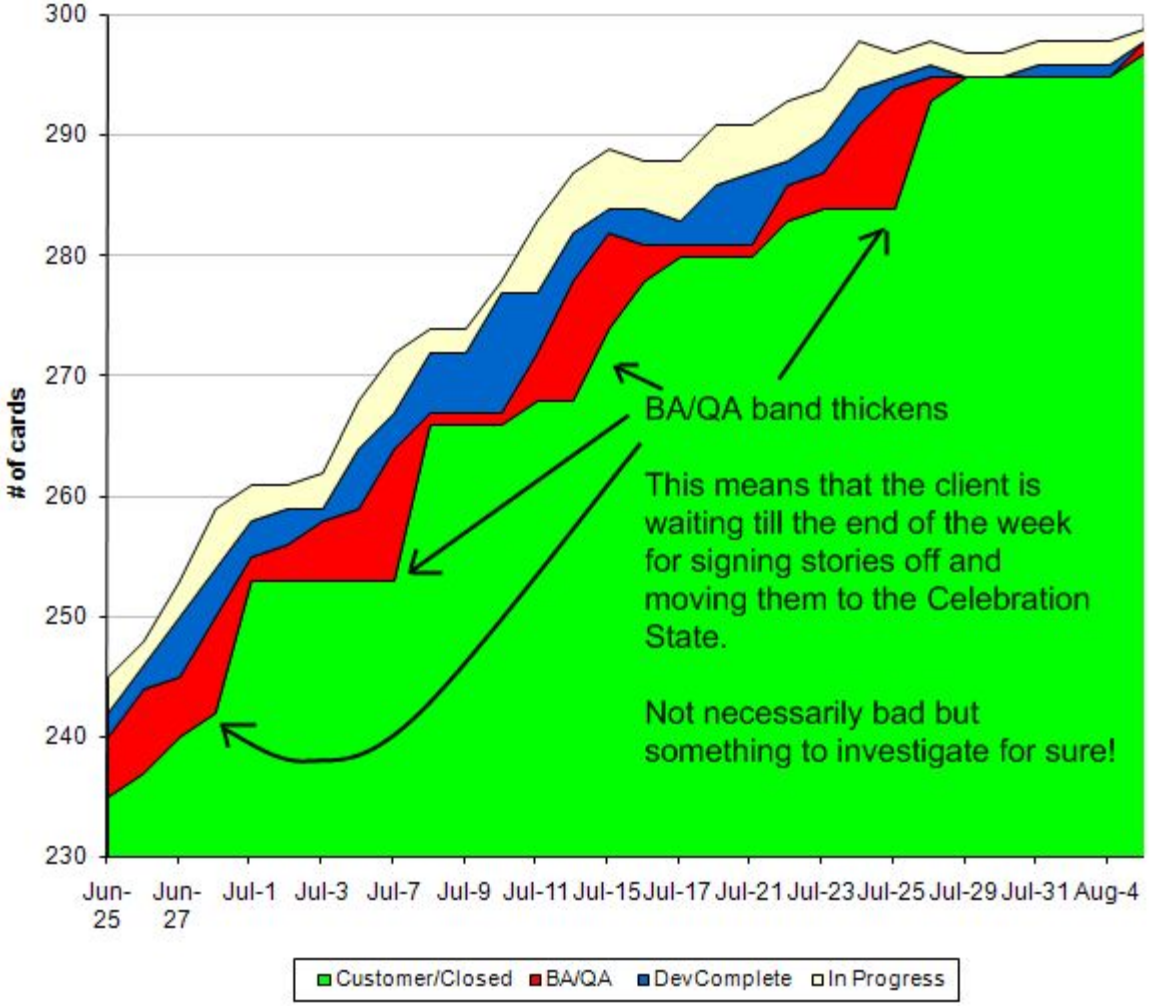
Leading indicator of cycle time

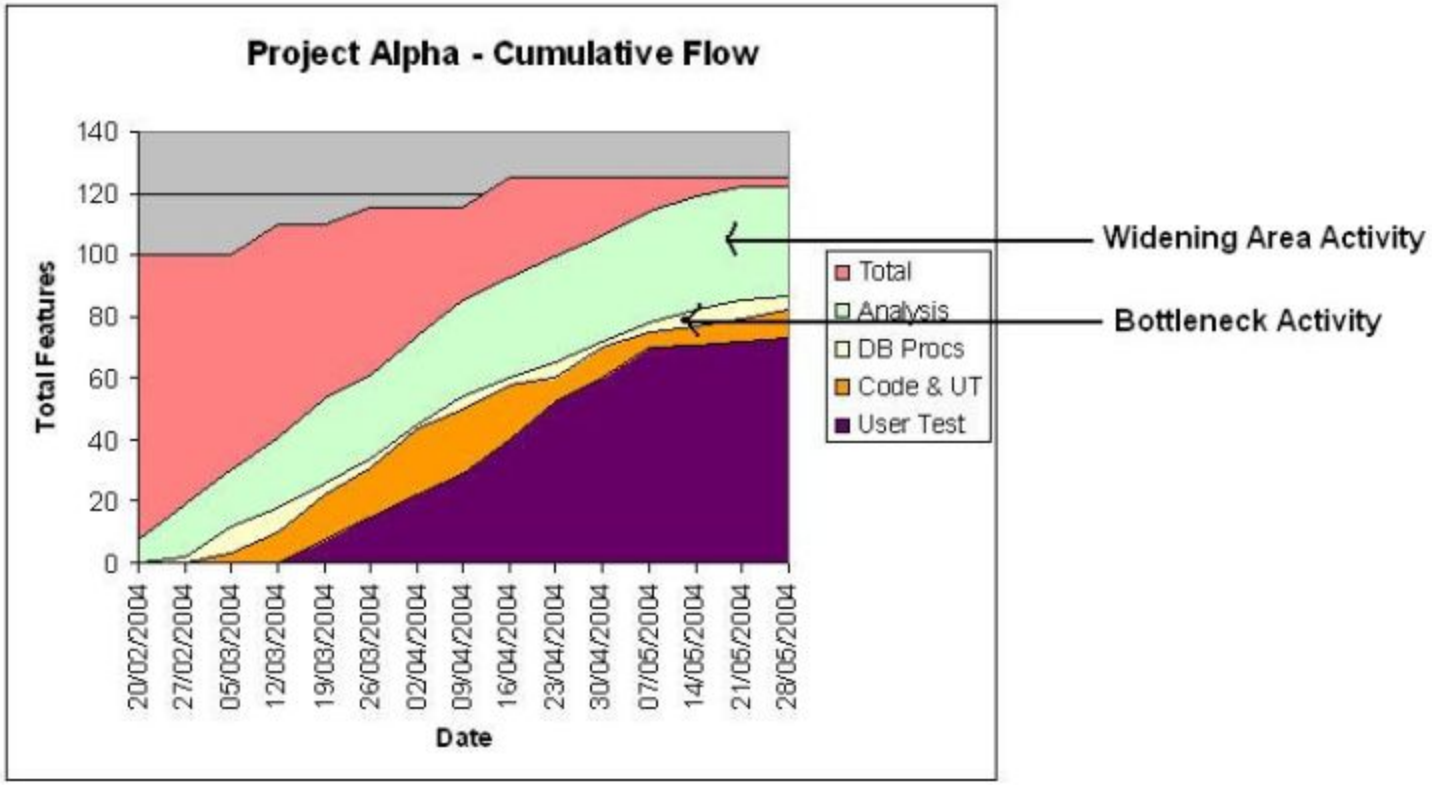


Paul Klipp

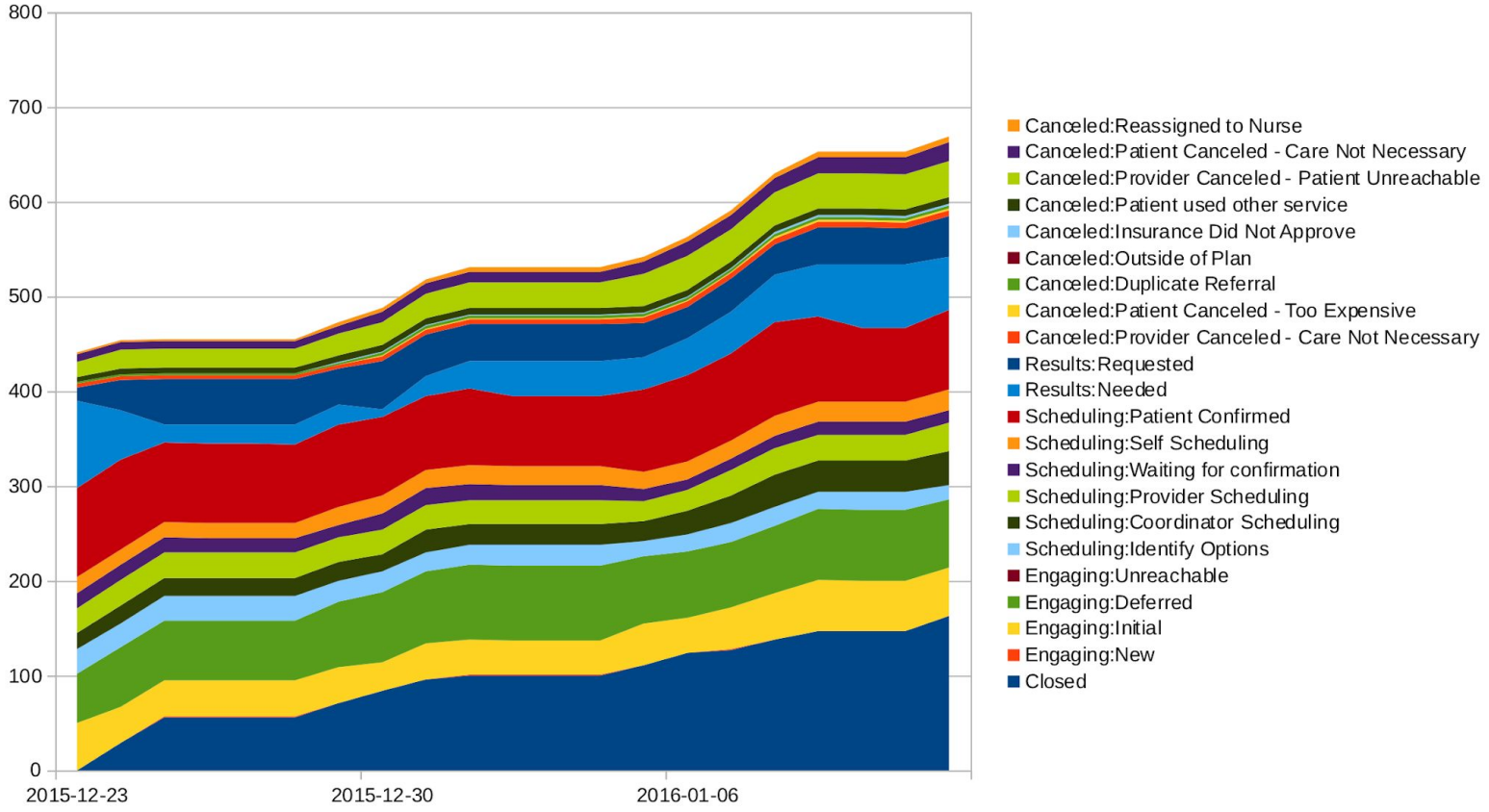
Cumulative Flow Diagram




300
290
280
270
260
250
240
230
# of cards
Jun-25
Jun-27
Jul-1
Jul-3
Jul-7
Jul-9
Jul-11
Jul-15
Jul-17
Jul-21
Jul-23
Jul-25
Jul-29
Jul-31
Aug-4
BA/QA band thickens
This means that the client is waiting till the end of the week for signing stories off and moving them to the Celebration State.
Not necessarily bad but something to investigate for sure!
Customer/Closed
BA/QA
DevComplete
In Progress


Project Alpha - Cumulative Flow
Total Features
140
120
100
80
60
40
20
0
20/02/2004
27/02/2004
05/03/2004
12/03/2004
19/03/2004
26/03/2004
02/04/2004
09/04/2004
16/04/2004
23/04/2004
30/04/2004
07/05/2004
14/05/2004
21/05/2004
28/05/2004
Date
Total
Analysis
DB Procs
Code & UT
User Test
Widening Area Activity
Bottleneck Activity

Reading a coordinator CFD



Takeaways / Questions