



Project Planning using Little's Law

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In Kanban a project is a batch of work items each representing independent customer value that must be delivered at or before a certain date

When planning a project

- You need to provide some idea as to when the project is going to be delivered.
- You need to provide a quote to the customer of how much the project will cost so she can decide whether to commit or not.

Little's Law for production systems

$$\overline{TH} = \frac{\overline{WIP}}{\overline{LT}}$$

Little's Law applies to any system, and
particularly, it applies to systems
within systems

Little's Law holds in case of a project

1. We must have conservation of Flow

The average output or departure rate (TH) equals the average input or arrival rate (λ)

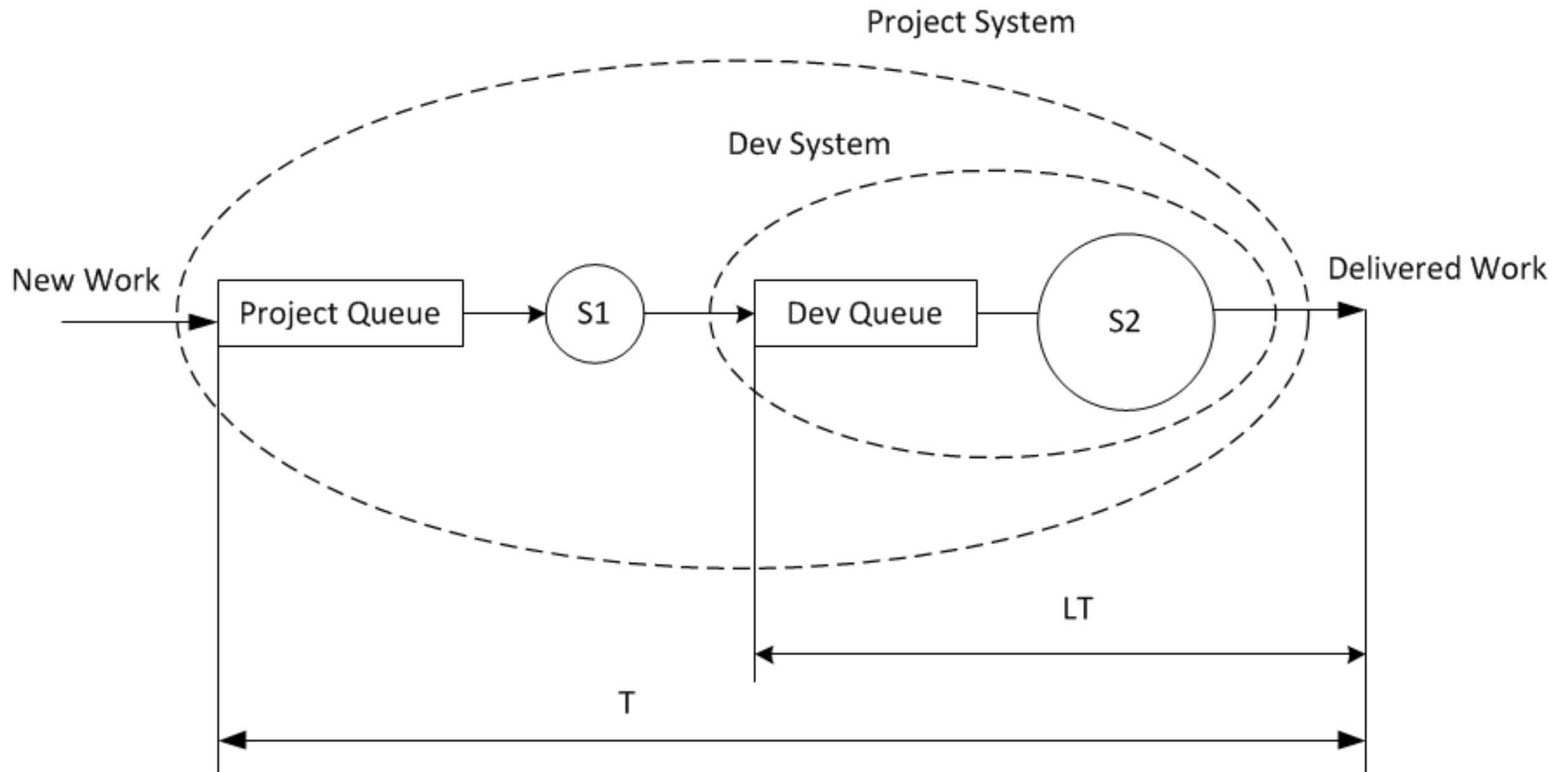
There are no work items that get lost or never depart from the system

2. The system must occasionally empty, i.e., $WIP = 0$

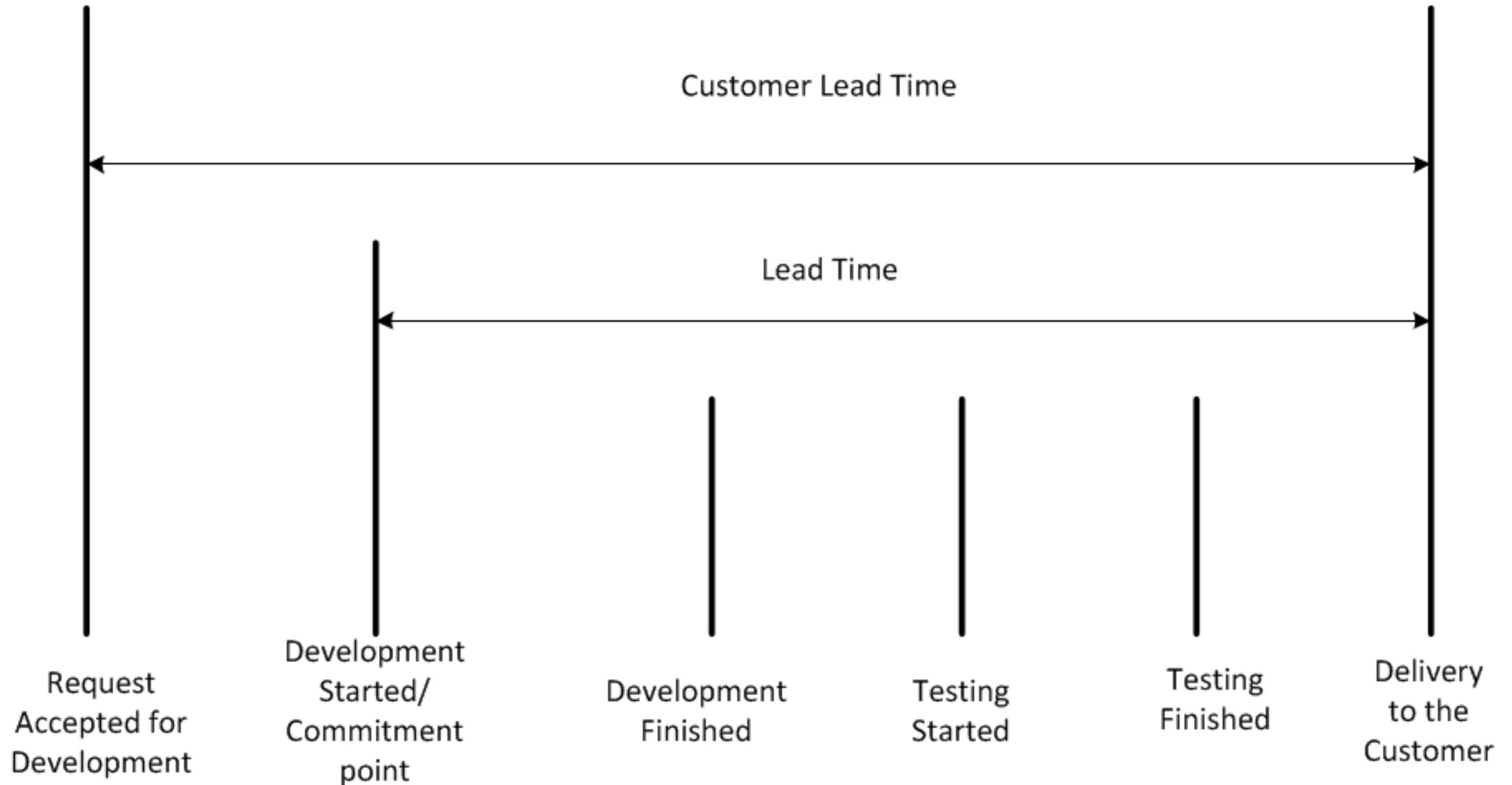
Little's Law can help us calculate the average Lead Time for a work item.

But we need a relationship between the average Lead Time for a work item and the finite time period over which the project will be delivered!

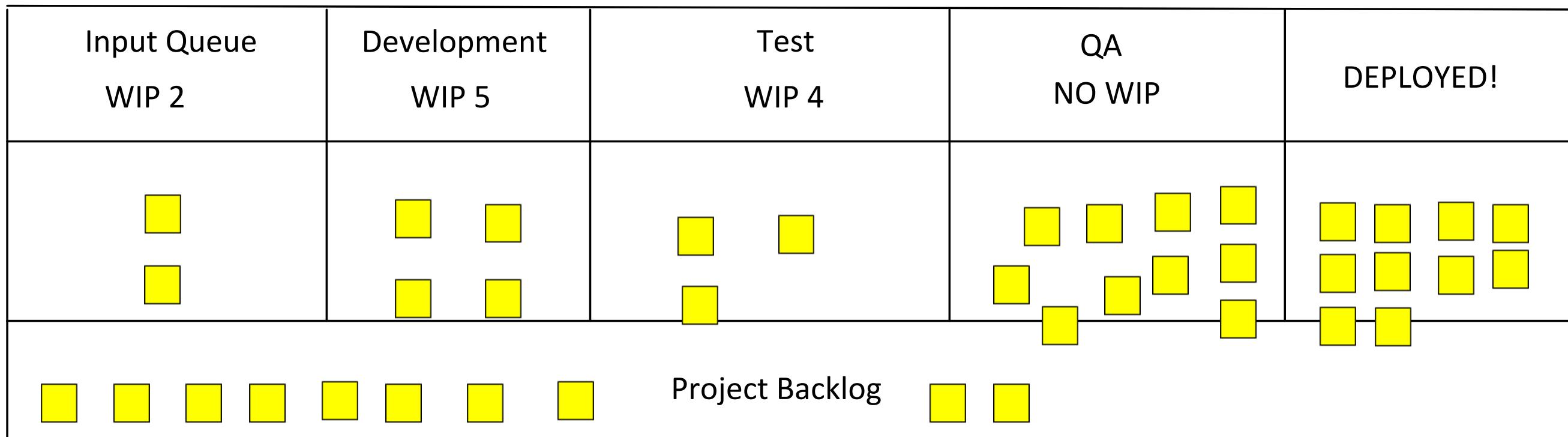
A Kanban system is a queuing system!



How we measure Lead Time?



Visual kanban system



Average throughput of the project
system equals the average throughput
of the development system!

Proof using mathematical notation

$$\overline{TH}_p = \overline{TH}_t$$

$$\overline{TH}_p = \frac{N}{T}$$

$$T = \frac{N}{\overline{TH}_p} = \frac{N}{\overline{TH}_t} = \frac{N}{\frac{\overline{WIP}_t}{\overline{LT}_t}} = \frac{N\overline{LT}_t}{\overline{WIP}_t}$$

Calculating Lead time for the project :

$$T = N \frac{\overline{LT}_t}{\overline{WIP}_t}$$

Number of developers we will need:

$$\overline{WIP}_t = \overline{LT}_t \frac{N}{T}$$

Examples

Calculating project delivery date

- Major project with 2200 user stories
- Average lead time for the development organization is 0.4 weeks
- Average work in process which is 22 user stories

$$T = N \frac{\overline{LT}_t}{\overline{WIP}_t} = 2200 \frac{0.4}{22} = 40 \text{ weeks}$$

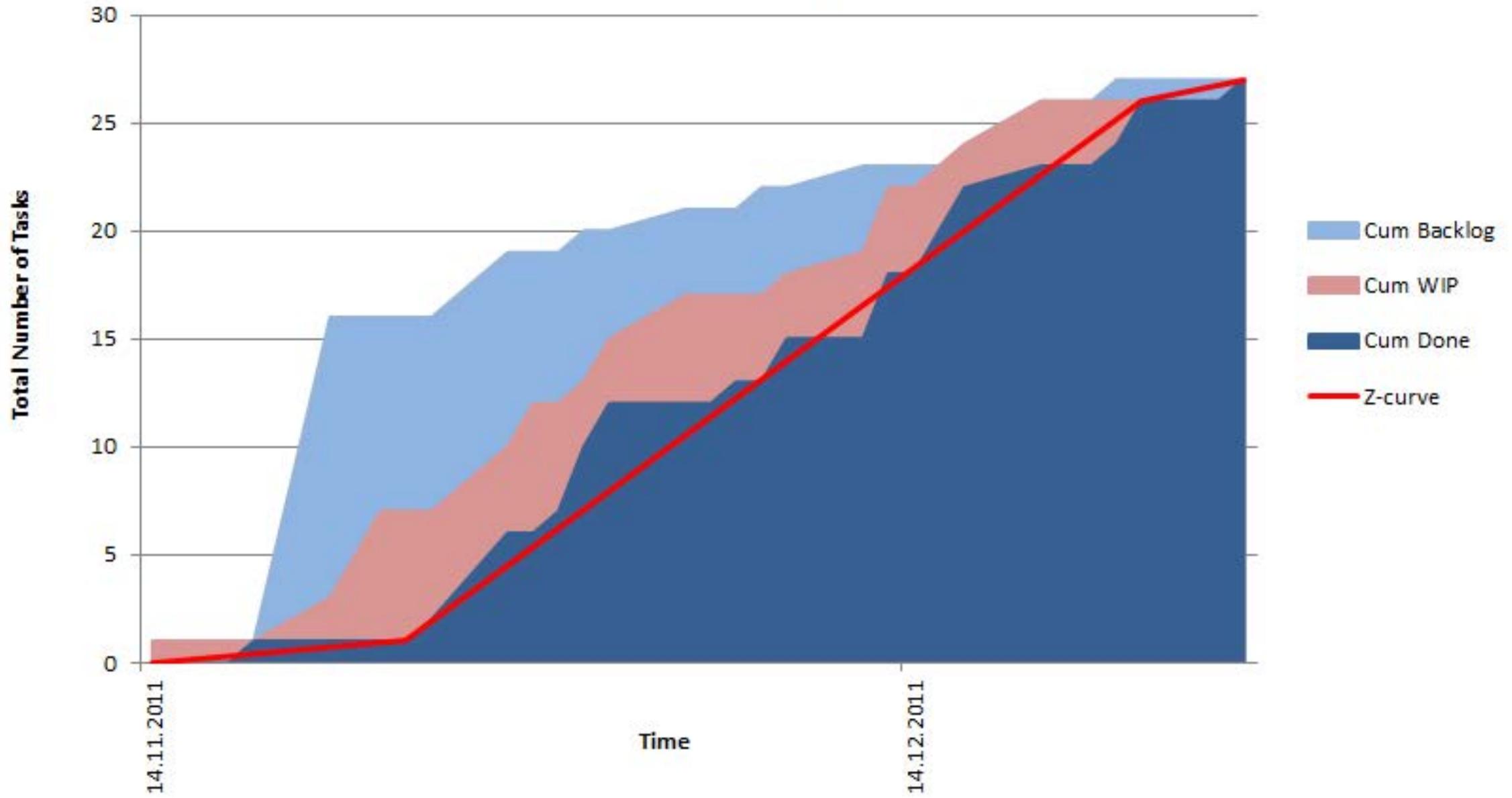
Budgeting a project

- Major project with 2200 user stories to be delivered
- Business needs the project delivered in 10 months
- Average lead time for the development organization is 0.4 weeks

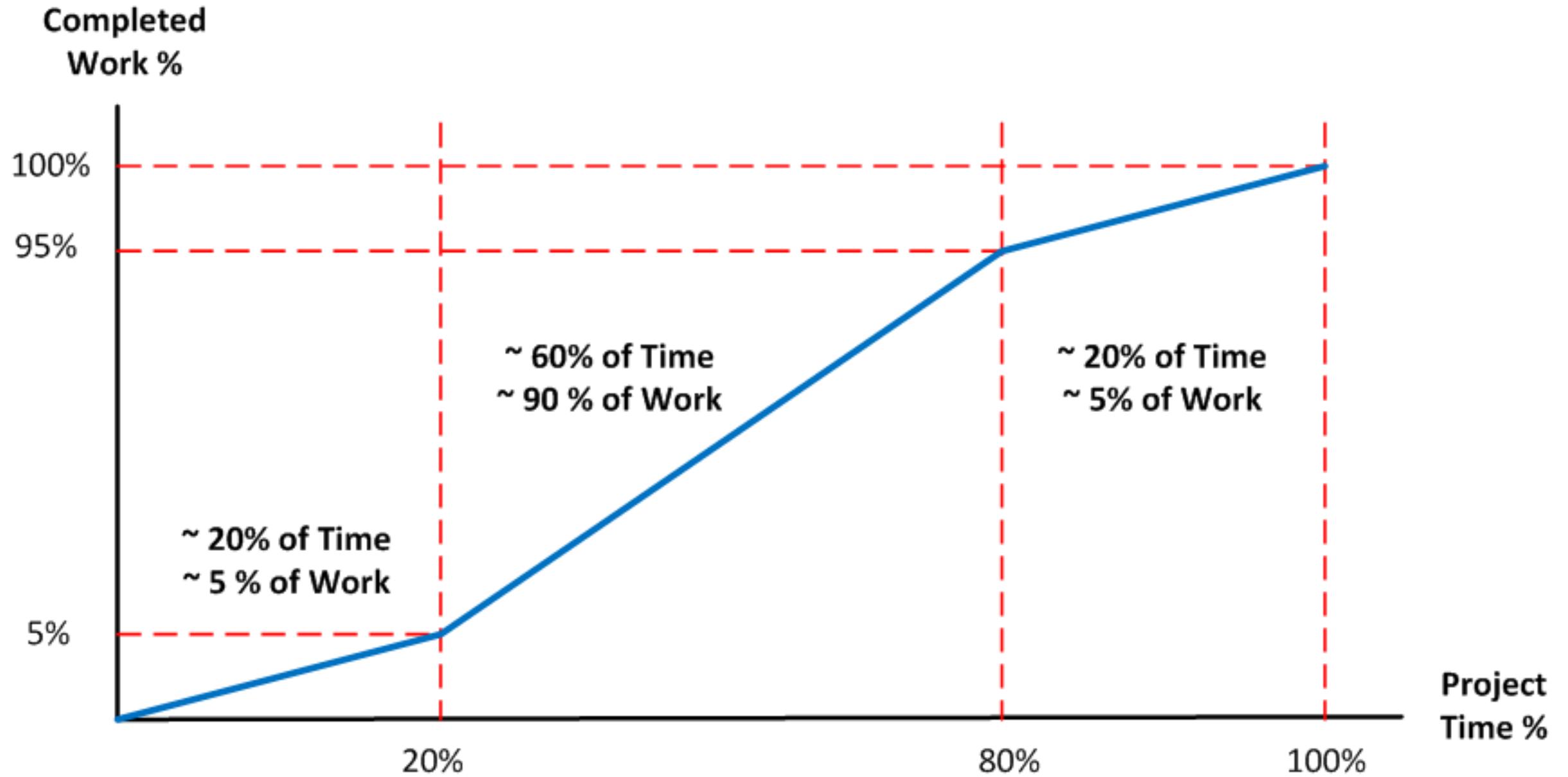
$$\overline{WIP}_t = \overline{LT}_t \frac{N}{T} = 0.4 \frac{2200}{40} = 22 \text{ user stories}$$

Calculated delivery time should be used only for the second leg of the Z-curve!

Cumulative Flow Diagram



Z-curve



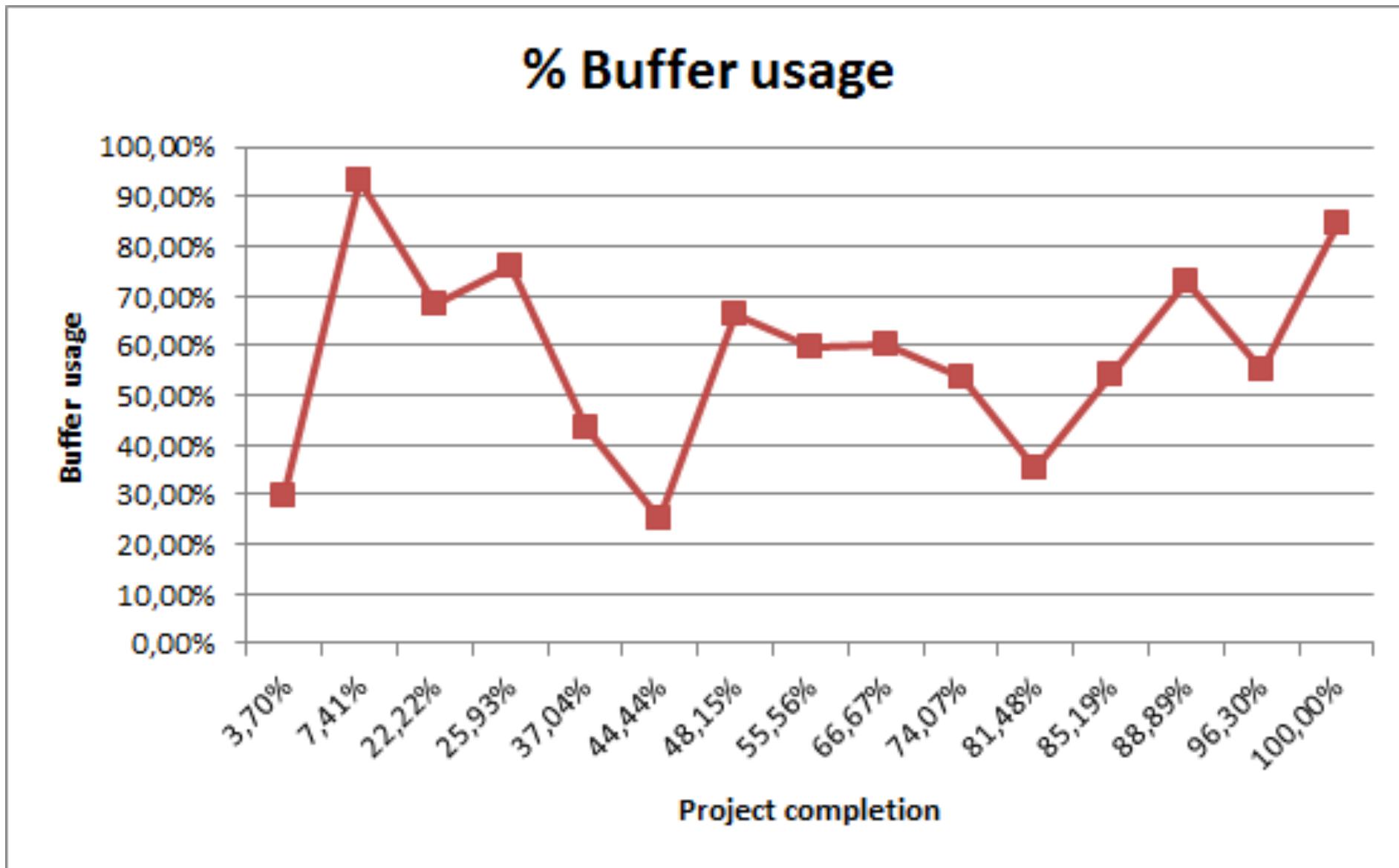
When calculating Project lead time we need to:

- Account for the other two legs of the Z-curve
- Account for Dark Matter
- Account for Failure load

Planned Project lead time is the sum
of the calculated project length and a
project buffer

The two essential measurements of project performance are the percentage of the project completed and the amount of the project buffer consumed.

Buffer consumption



Project Buffer length calculation

$$PB = ZC \frac{(1 + FL + DM)N}{\overline{TH}}$$

Percentage of the project completed

$PC_t = \frac{\sum_{i=0}^t N_i}{N} 100\%$ is percent of work items delivered out of total work items to be delivered at time t

Project buffer consumption

$PBU_t = \frac{(ALT_t - PLT_t)}{PB} 100\%$ is the percent of the Project Buffer consumed at time t

$$ALT_t = T_t - T_0$$
$$PLT_t = \frac{LT}{WIP} \sum_{i=0}^t N_i$$