

# A Software Engineering Capstone Infrastructure that Encourages Spreading Work Over Time and Team

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HOW can instructors spreading out the work in computing capstone courses across time and among team members? We propose using a GitHub template that contains all the initial infrastructure, including the folder structure, text-based template documents and template issues. In addition, we propose each team begins the year by identifying specific quantifiable individual productivity metrics for monitoring, such as the count of meetings attended, issues closed and number of commits.

## 1. Proposed Process and Infrastructure

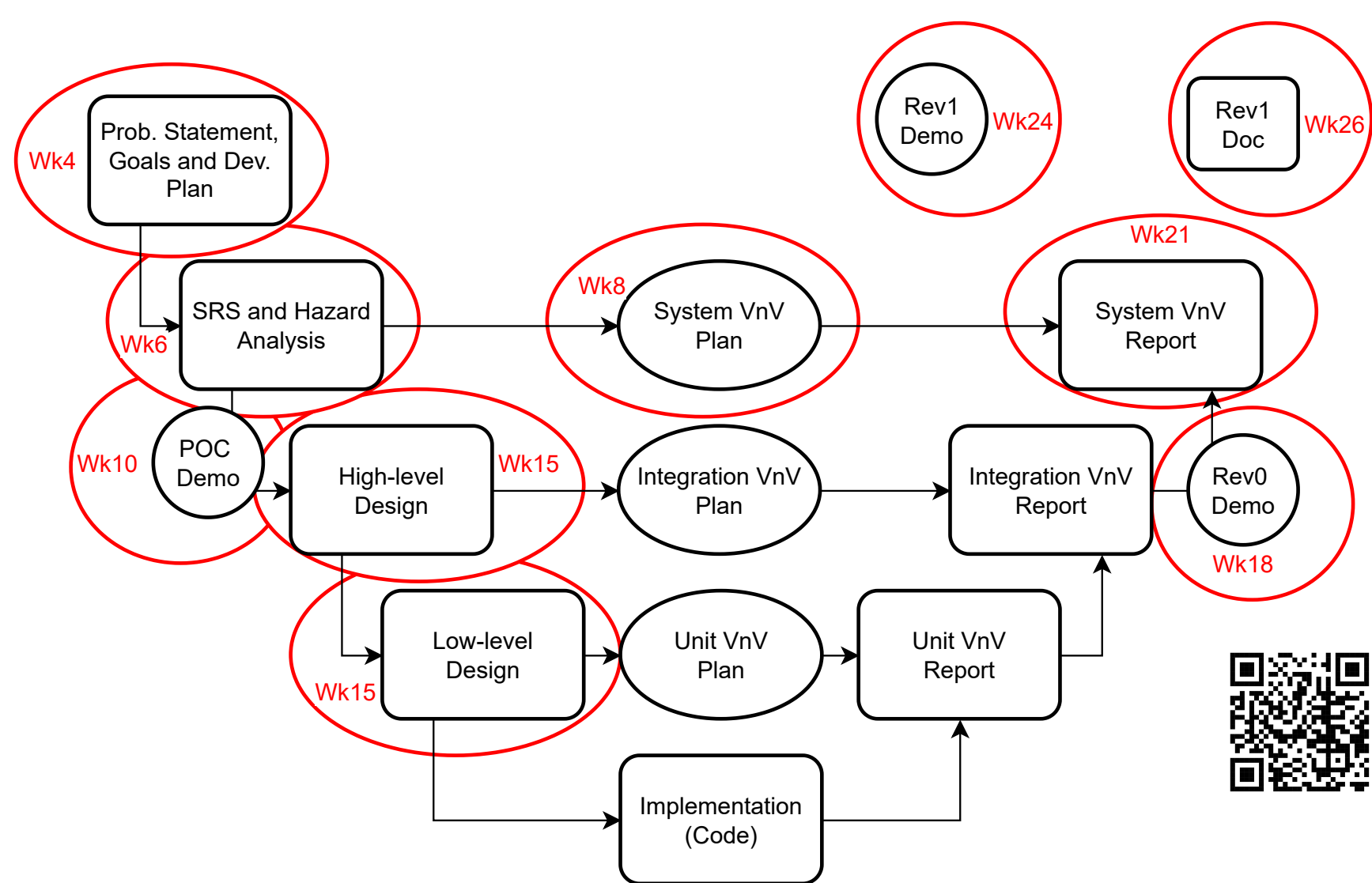


Figure 1: V Model Used for Capstone Deliverables

In an 8-month capstone course, teams of 4–5 follow a V-model process. They propose a team charter that includes specific quantifiable expectations and consequences. Team member productivity is reported to the instructor. A template Github repository is used for standardization and to save time.

## 2. Time Spread Before and After

Table 1: T0 on deadline, T2 up to two days prior

| Metric        | 2022/23 Value | 2023/24 Value |
|---------------|---------------|---------------|
| Total Commits | 6140          | 5120          |
| T0 Commits    | 1471 (23.96%) | 942 (18.40%)  |
| T2 Commits    | 2377 (38.71%) | 1872 (36.56%) |

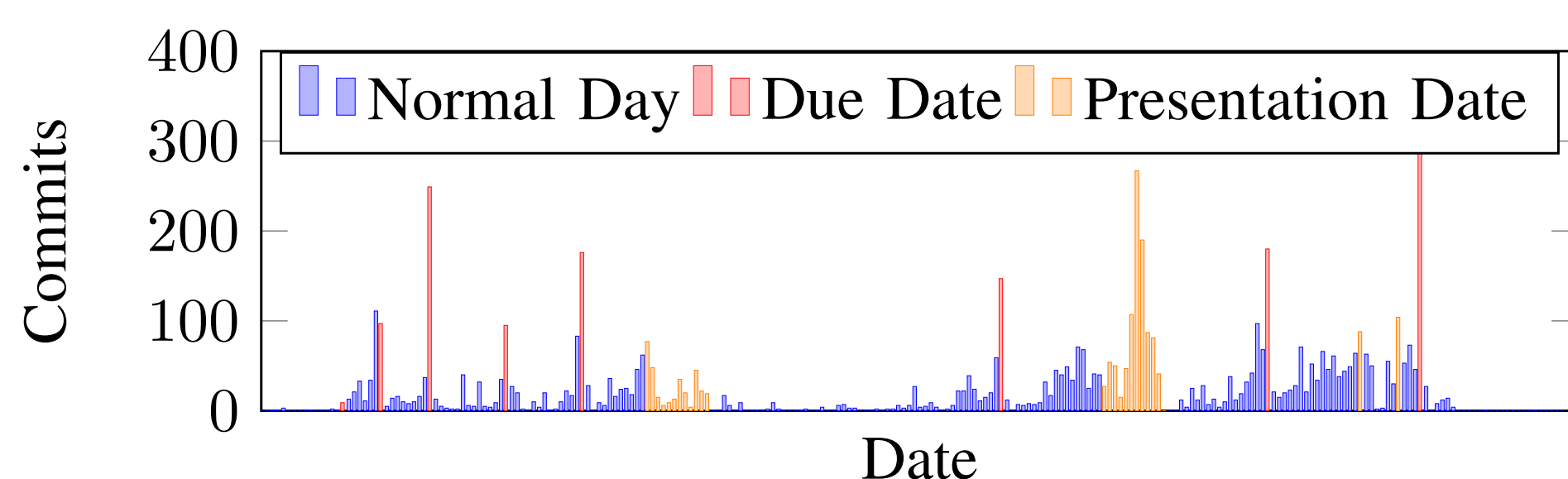


Figure 2: Commits for 2022–2023.

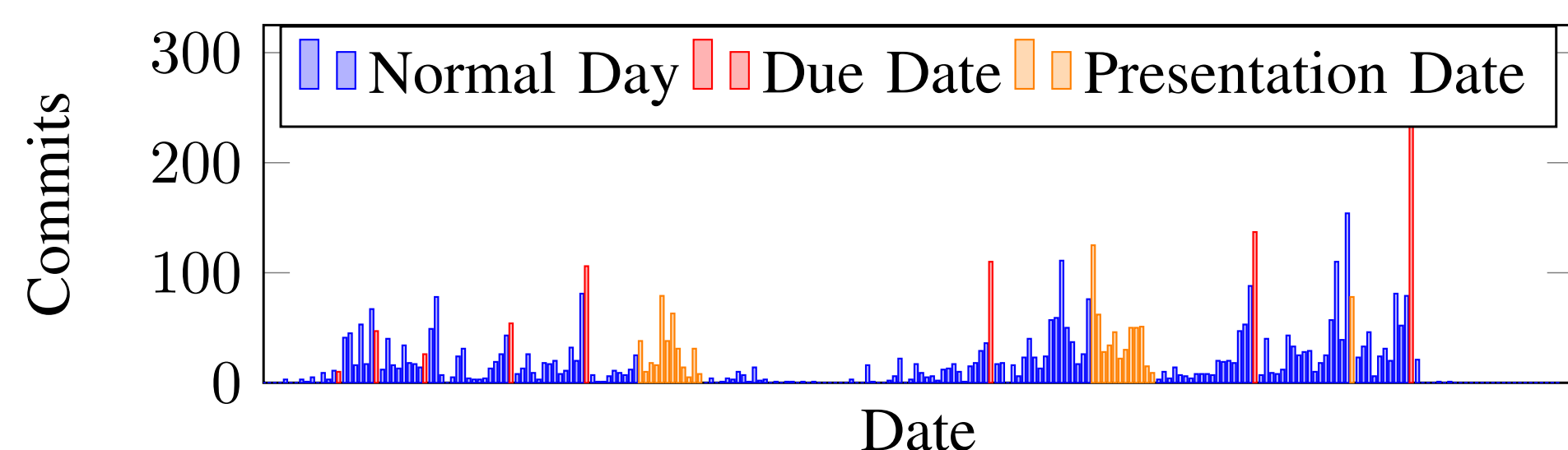


Figure 3: Commits for 2023–2024.

## Team Fairness Before and After

$$\text{unfairness}(C) = \frac{\sum_{c, x \in C, c > x} (c - x)}{(|C| - 1) \cdot \sum_{c \in C} c}$$

where  $C$  is the multiset of teammates' numbers of commits to the repository. The index computes the sum of the difference between each teammate's commits and those who committed less than them, normalized by the number of teammates (excluding themselves) and the total number of commits. This yields a value from 0 to 1, called the *unfairness* index. Fairness is defined as  $\text{fairness}(C) = 1 - \text{unfairness}(C)$ .

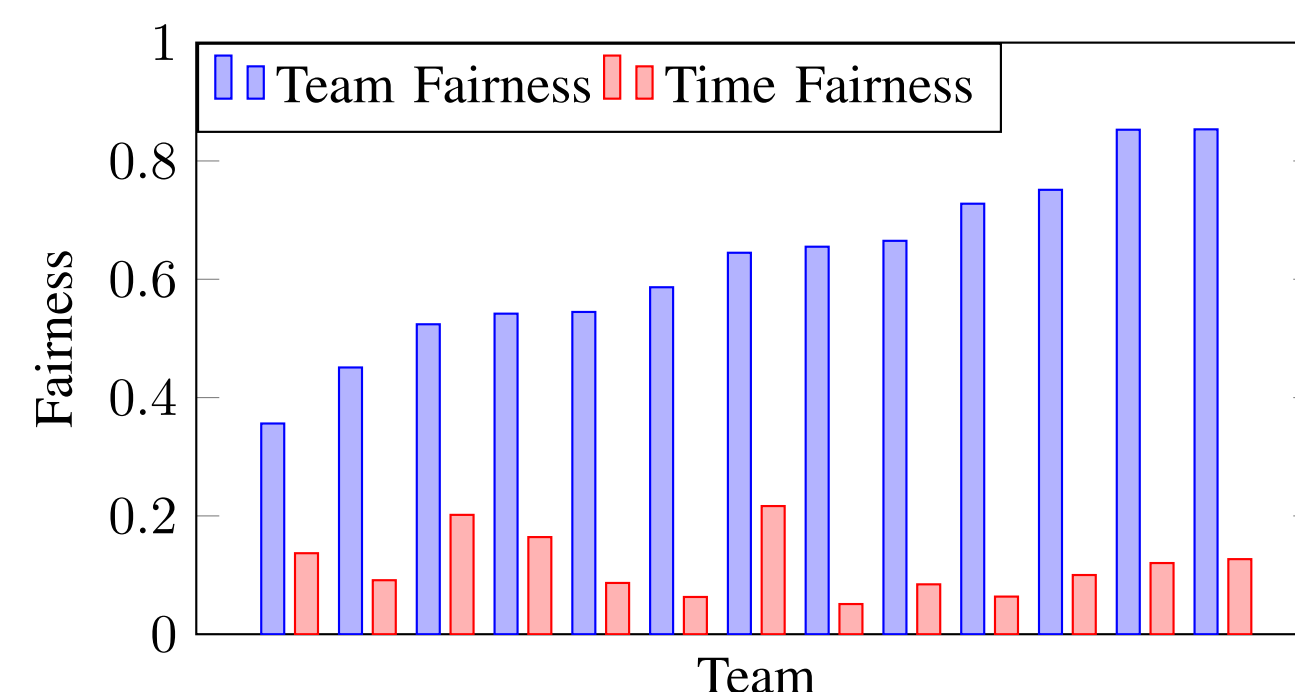


Figure 4: Fairness of Commits 2022/23 [ $n=13$ ; Team Fairness Mean: 0.63, Stddev: 0.15; Time Fairness Mean: 0.12, Stddev: 0.05; Correlation: -0.16]

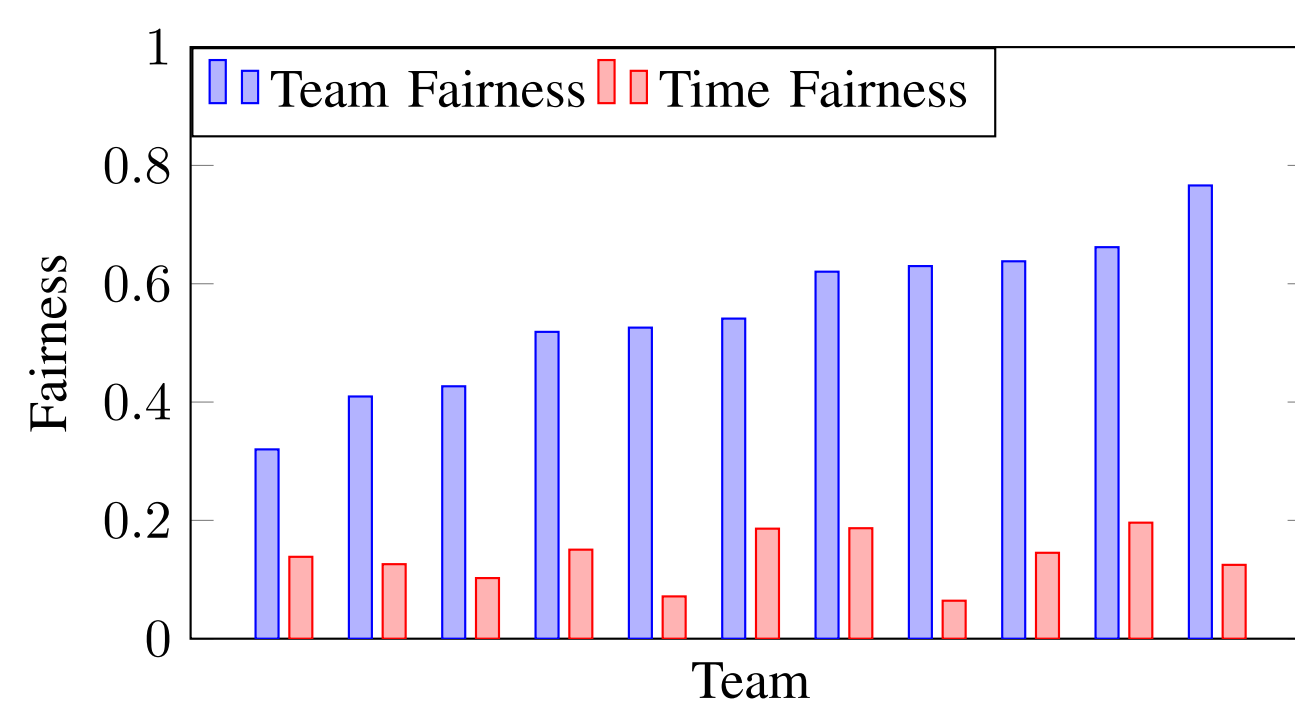


Figure 5: Fairness of Commits 2023/24 [ $n=11$ ; Team Fairness Mean: 0.55, Stddev: 0.13; Time Fairness Mean: 0.14, Stddev: 0.04; Correlation: 0.15]

## 3. Conclusions

PRELIMINARY data suggests that these steps may have an impact. In the base year we observed 24% of commits happening on the due dates, but after partially introducing the proposed interventions this number improved to 18%. Going forward, we propose an experiment where commit data and interview data is compared between teams that use the proposed interventions and those that do not.

