

# Using Integer Programming to Build Call Schedules for Trauma Surgery Faculty

Amy Cohn, PhD, Jhawan Davis, Caroline Owens, William Pozehl, Hannah Strat, Kristine Wang, Krishnan (“Raghu”) Raghavendran, MD, FACS, and Penny Trinkle

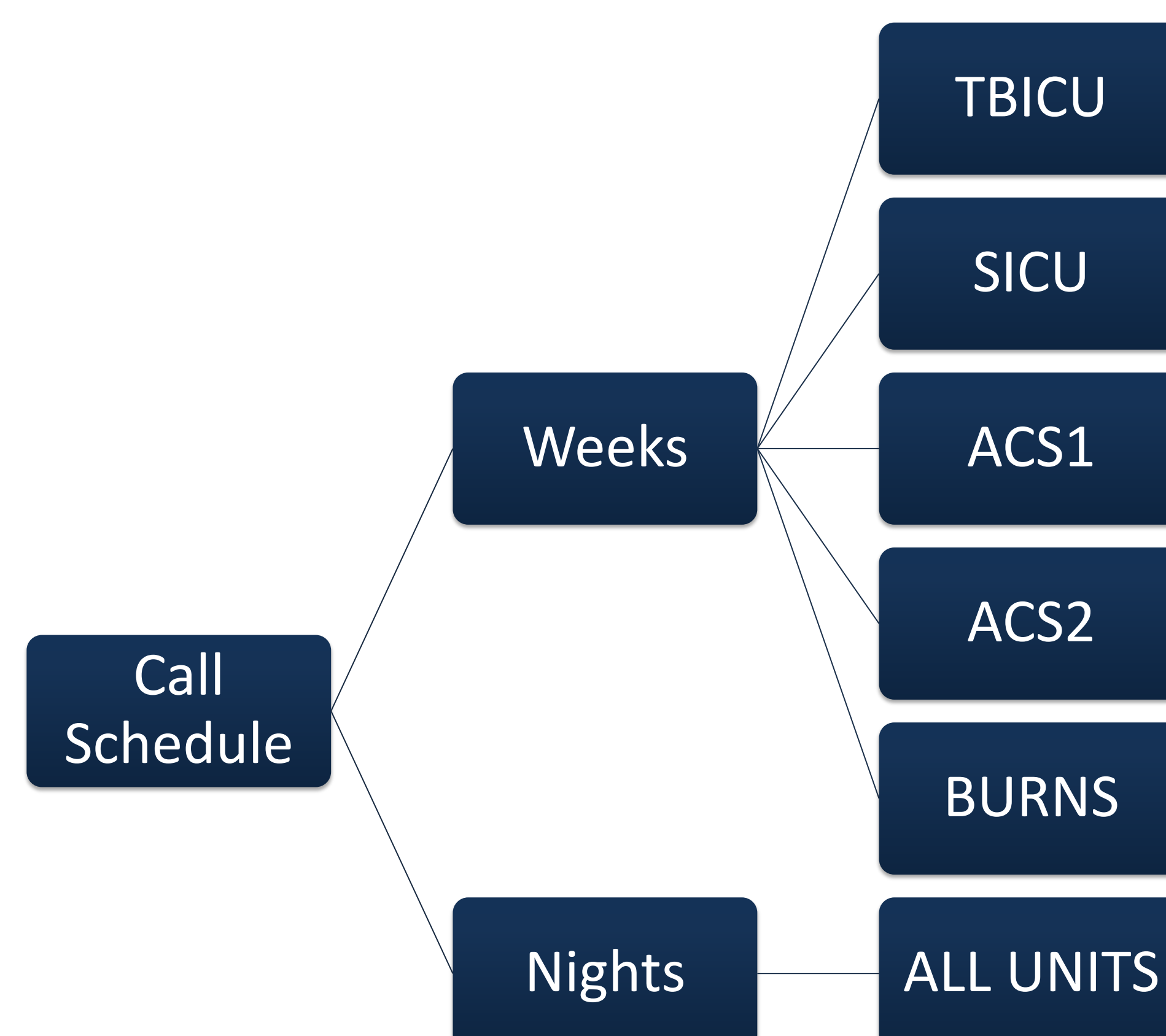
## Background

- The Trauma Surgery Faculty are assigned approximately 8-10 weeks across 5 different units over a 6-month schedule.
- The Division Chief currently schedules the 6-month horizon by hand. After the chief sends out the schedules, faculty members can send their comments and the schedule is repeatedly revised until a final version is agreed upon. We aim to improve this process by automating the scheduling to produce faster and more equitable results.
- Once the weekly schedule has been finalized the Division Chief moves on to scheduling Night Call.

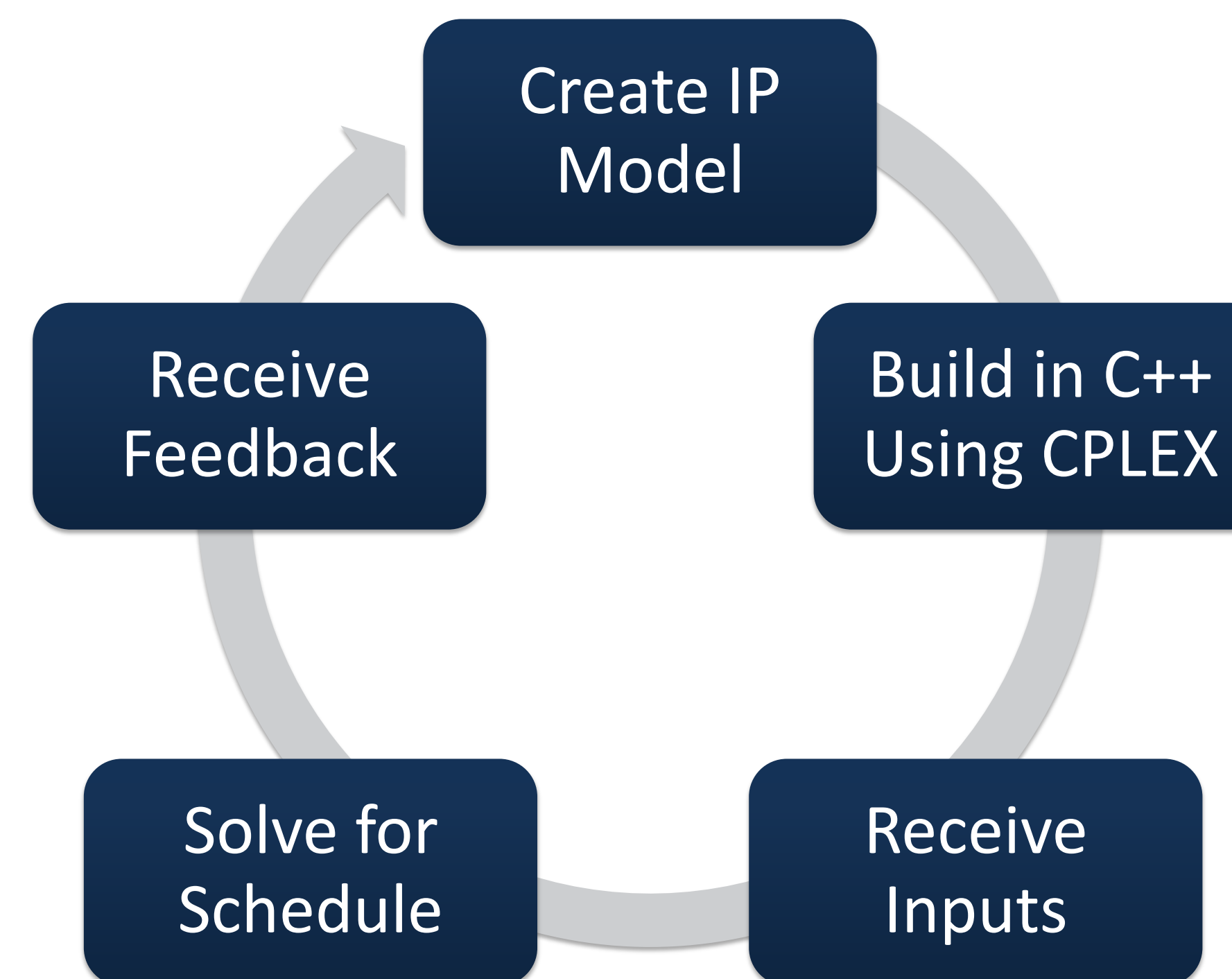


## Methods

- We formulate the problem as an integer programming model.
- In collaboration with the Division Chief and Administrative Specialist of Acute Care Surgery, we have developed metrics to ensure a feasible schedule of high quality.
- We are currently creating a computerized tool which will receive inputs from the Division Chief and build a high quality schedule quickly.
- The schedule will then be sent to the Division Chief and attendings for review.



## Solution Approach



### Decisions

Is attending  $a$  assigned to unit  $u$  on week  $w$ ?

$$x_{auw} \in \{0,1\}, \forall a \in A, u \in U, w \in W$$

Is attending  $a$  assigned to unit  $u$  on week  $w$ ?

$$y_{aw} \in \{0,1\}, \forall a \in A, w \in W$$

### Rules

There are certain constraints necessary to ensure a feasible schedule. These constraints were realized in discussion with the Division Chief, Administrative Assistant and CHEPS Trauma Call Team.

- Attending Assignments
- Prohibit Unit Pairs
- Maximum Consecutive Work Weeks
- Unit Coverage
- Burns Coverage
- Bounds on Attendings' Total Non-Burns Unit Assignments
- Bounds on Attendings' Individual Non-Burns Unit Assignments
- Bounds on Attendings' Burns Unit Assignments
- Preassignments
- Prohibitions

### Metrics

Other constraints were developed in order to rank the quality of feasible schedules and determine which output is best for the Trauma Surgery Faculty. The following metrics were established in discussions with the Division Chief, Administrative Assistants and CHEPS Trauma Call Team.

- Preferred Week Off Requests Denied
- Swap Weeks
- Attending Unit Assignment Deviation
- Overlap of Burns and Non-Burns Unit Assignments

## Next Steps

### Create Nights Schedule

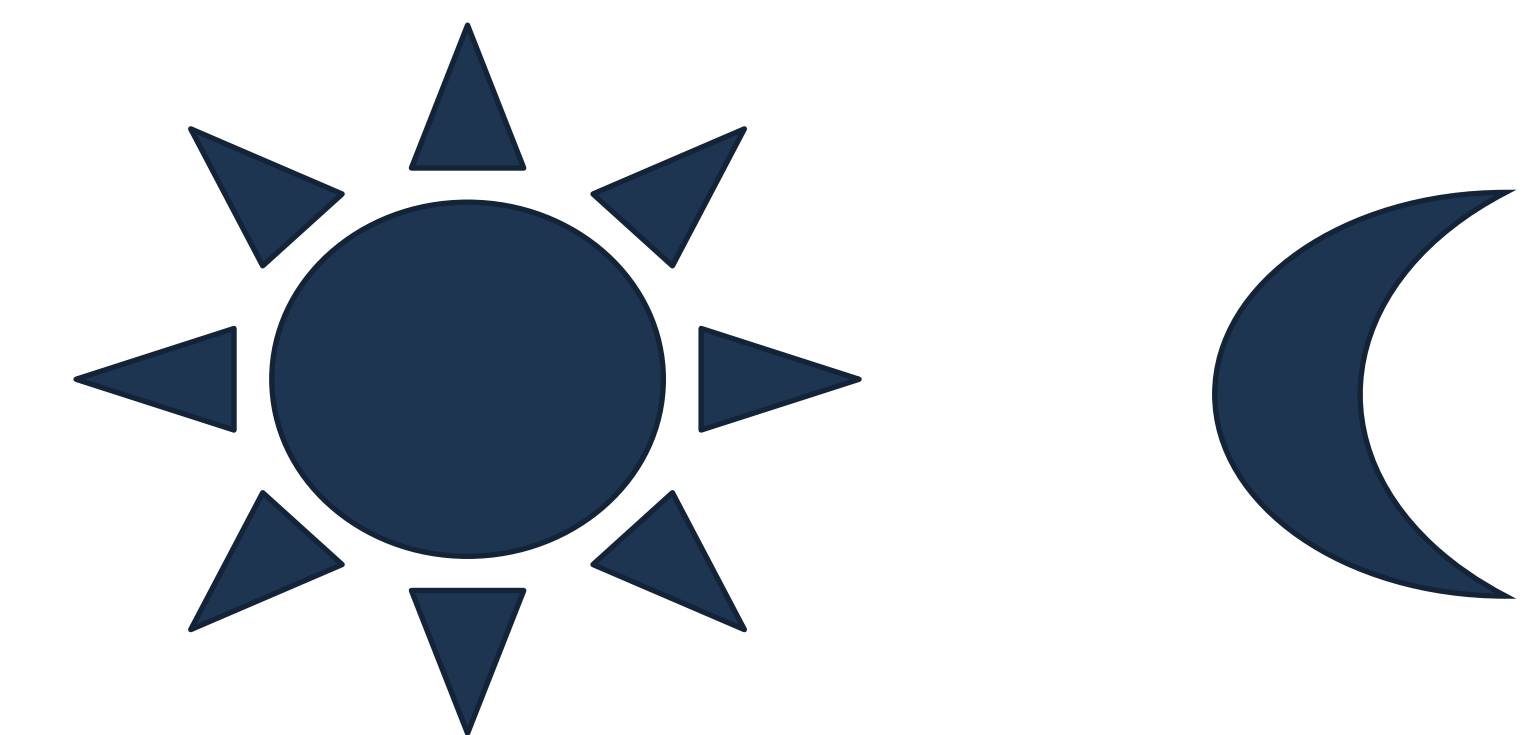
- Night Call for Trauma Faculty scheduled by day
- Develop rules and metrics for Night Call

### Track Assignments

- Summarize assignments long-term to track equity

### Hand-off of Scheduling

- Enable scheduling by Division Chief



## Expected Impact

### Improved Coverage Equity

- Ensure accurate assignments

### Increase Number of Off-Requests Granted

### Free Time for Division Chief

- Enable time for education
- Develop relationships between the College of Engineering and Michigan Medicine

### Experiences for Student Researchers

- Direct contact with providers and hospital

## Acknowledgements

We thank the following organizations for funding this work:



University of Michigan  
Medical School



CENTER FOR  
HEALTHCARE ENGINEERING & PATIENT SAFETY  
UNIVERSITY OF MICHIGAN

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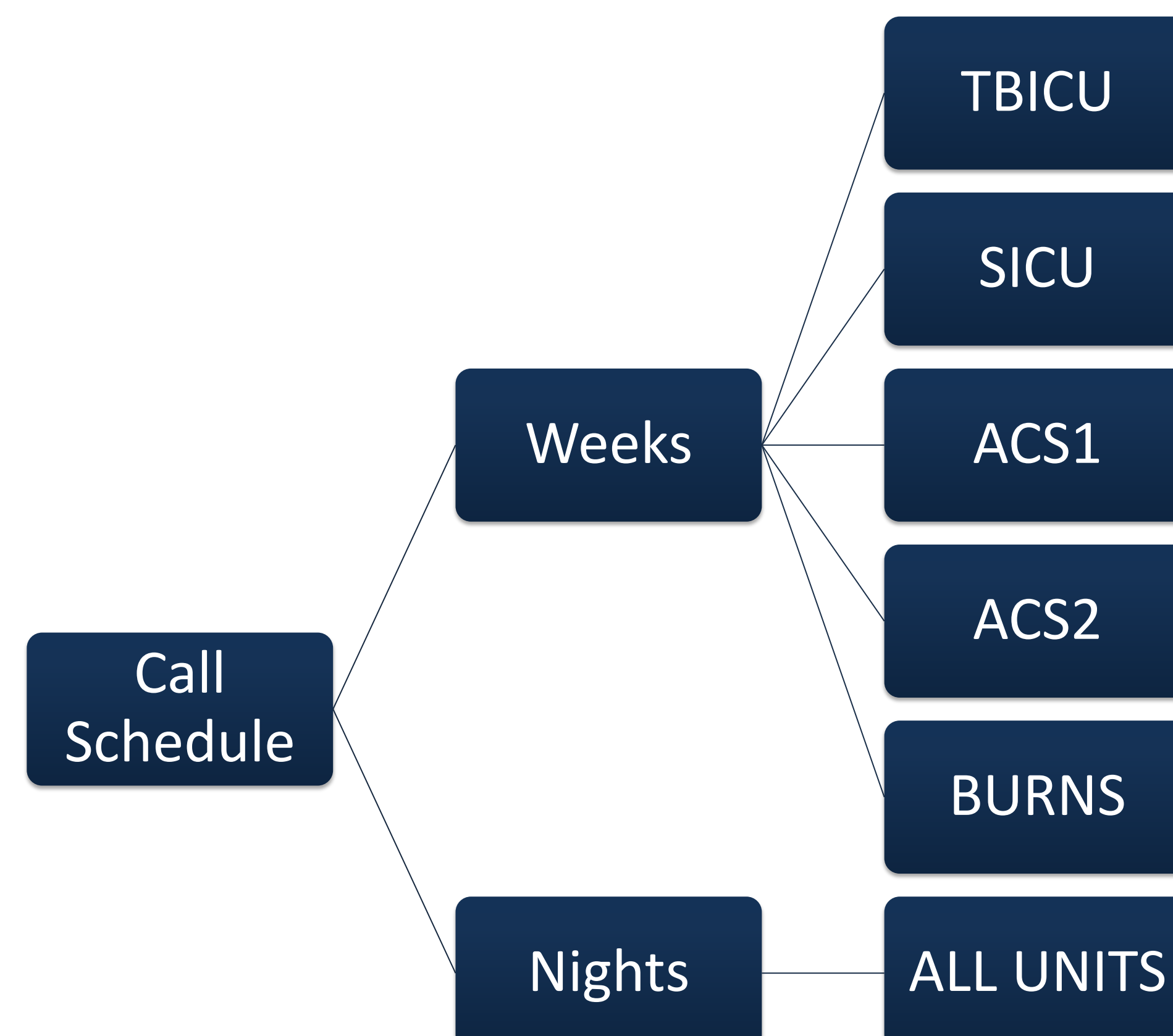
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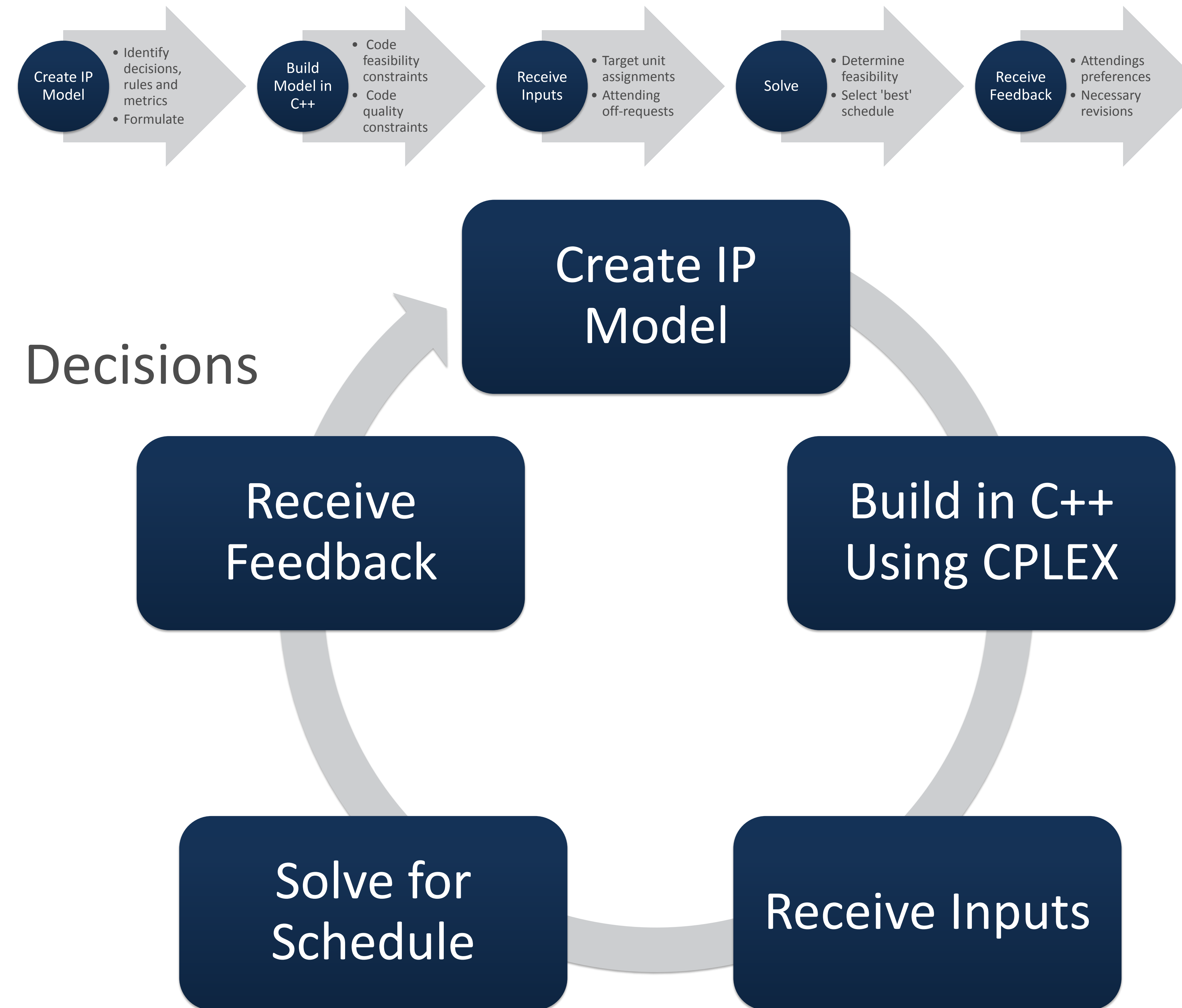


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## Impact

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