

# Scheduling and 3D Model of Residential Building in GIS Environment

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**Abstract:** Presently construction industry requires highly exceedingly exact scheduling, planning and management procedure for the project which can empower the general optimization of the cost, time and assets. The development organizer uses 2-dimensional drafting/illustrations and goes with the constituents of the illustrations with the concerned exercises of the schedule. They used MS Project and Primavera for scheduling, AutoCAD drawings to visualize, plan and decision making for different construction activities. It uses multi environment and time consuming too. Thus, clarifying the status of the venture to the customer turns out to be exceptionally troublesome and tedious. In this way, the customer and the store administrator probably won't be familiar with the specialized terms utilized in the schedule and graphical portrayals. Thus, the construction enterprise necessitates an implement that can influence the schedule and 3 Dimensional constituents in particular individual environs from Multi environs. Instead of using the older, traditional methods of CAD drawings and schedule sheets, one can integrate them on a platform to create a 3dimensional view of the project using GIS environment. The objective of study is to create scheduling and 3-dimensional model in single environment using GIS only for a G+1 residential building at Vaddeswaram. It has been found that from actual building data at site and the building simulation demonstrate, some superposing and rework can be kept away from.

**Index Terms:** Environmental Geographic information system, Scheduling, Auto CAD, Python, Construction management, project management

## I. INTRODUCTION

The customary methodology for planning and advancement observing systems likes bar graphs, CPM, PERT and so forth are as yet being utilized by the undertaking directors for arranging. Geographical Information System (GIS) and task the Executives devices in a blend can be utilized to get to the spatial viewpoints and the time and cost engaged with the undertaking. This paper demonstrated that making of 4D display utilizing GIS. This can be utilized as a planning management, planning and successful visualization of the work. Preferred standpoint of this work is covering and modify can be dodged and reduce delay [1]. This paper displays a GIS relied system to speak to and coordinate spatial and Non-spatial data, such as illustration, details, assets, and development plan for an individual environment. The significant end drawn from this exploration is that GIS based improvements give a development plan perception device as well as be utilized as a project the executive's

device at any Phase of the undertaking in which the schedule and the 3-dimensional segments can be controlled

in an individual domain [2]. This examination talked about the improvement of PMS-GIS as a tool for imagining development advance in three measurements, side by side with a CPM-created work plan. In correlation with current techniques, PMS-GIS has made another method for speaking to development advance in graphical terms utilizing GIS, CAD, and project the board programming [3]. Integrated GIS based 4D model has been developed and utilized for the visualization of the construction progress of the project [4]. This paper purpose a methodology to use GIS in representing and integrating the spatial and Non-spatial information on the single environment [5]. The proposed procedure in this paper firmly elevates 4D GIS idea to incorporate and speak to spatial and Non-spatial data like project illustrations, resources, specification, and the schedule arranged in single environment [6]. Integrating project schedule data with GIS technology present a 4D model which can be utilize the actual building model and the planned building model to compare the work in progress [7]. In this study, integration ARC GIS and ARCSCE, modules of GIS are used for interlinking of schedules and drawings. GIS allows activities and respective drawings in GIS helps in identifying construction sequences and in detecting logical errors in the project [8]. Hence, an efficient method is proposed in this study is implementing GIS as a platform to link the plan of building and its corresponding schedule of executing the construction of building. GIS is relatively an emerging field for managing the spatial and the non-spatial data. Aim of the study is intend to demonstrate the methodology of creating the GIS based 4D model optimization and real time monitoring of the project [9]. This paper describes a method for developing 4D simulation to visualize the criticality of project activities considering the requirements of the levels of details [10]. Creating complete work on GIS planning and scheduling. This will give the exact outcomes and taking least time. This fig will demonstrate 1. the arrangement of this building. Connecting the resourceful information of every activity with Relating 3-dimensional parts; and

2. Managing and altering data as the drawings, specification details, Schedule for an individual environment.

The sub-objectives are accomplished through the advancement of a database inside the GIS itself. The proposed technique like-wise permits obtaining the required data for a project's known activity from the database. A few new contents just as distinctive default functions of ArcMap10.2 are used. Since of the restricted spatial editing

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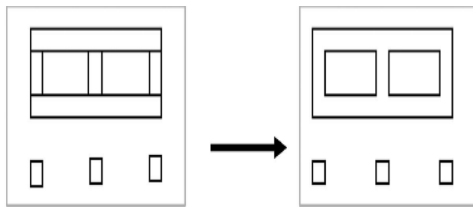
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capabilities of the Arc map10.2, Arc GIS 10.2 is utilized to produce distinctive 3dimensional parts of the building.

## II. GISTOOL FOR SCHEDULING

### A. Attributes Grouping:

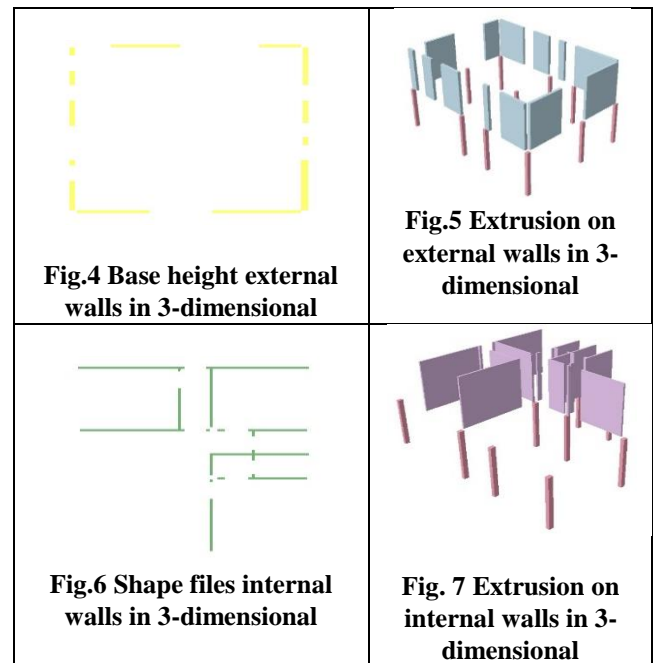
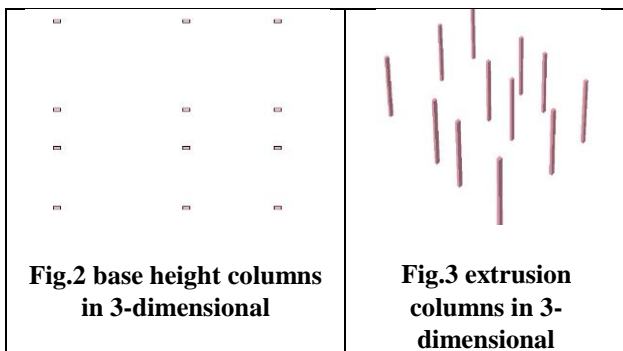
The merge functions in Arc GIS or union attributes Arc View groups attributes of a theme into one attribute. The tools consolidate attributes by expelling the limits or nodes between adjoining lines or polygons. For instance, Fig. 1 shows five walls (polygon attributes), which all are dissected into one using merge. These tools additionally join nonadjacent attributes to make one attribute. For instance, 3 nonadjacent attributes (square polygons) in same theme (Fig 1) are as well merged to make a multicomponent polygon attribute.



**Fig.1: Gathering of the chosen properties of a themes, which clears the limits among adjoining polygon features and nonadjacent attributes together to outline a multi segment polygon characteristic.**

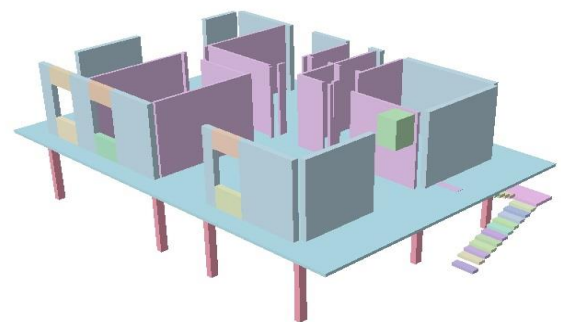
### B. Extrusion

The 2dimensionalthemes not having *base height* and *attribute height* data, where base height is the acme value and *feature height* is the height of attributes of a theme in 3-dimensional space. To show the 3dimensional viewpoint, all attributes of a 2-dimensional theme must be appointed *base height* and *feature height* from its own feature table. The extrusion implements (in Arc View/Arc GIS) alters the points into vertical lines, lines into vertical walls polygons into 3dimensional blocks. Fig. 2shows shape file of column. Fig. 3 shows extrusion of column. Fig. 4 shows shape file of external walls Fig. 5 shows extrusion on external walls in 3dimensional blocks Fig. 6 shows shape files of internal walls Fig 7 shows extrusion of internal walls.



**Fig.6 Shape files internal walls in 3-dimensional**

**Fig.7 Extrusion on internal walls in 3-dimensional**



**Fig 8: Final view of residential building**

## III. CPM PROGRAMMING IN GIS

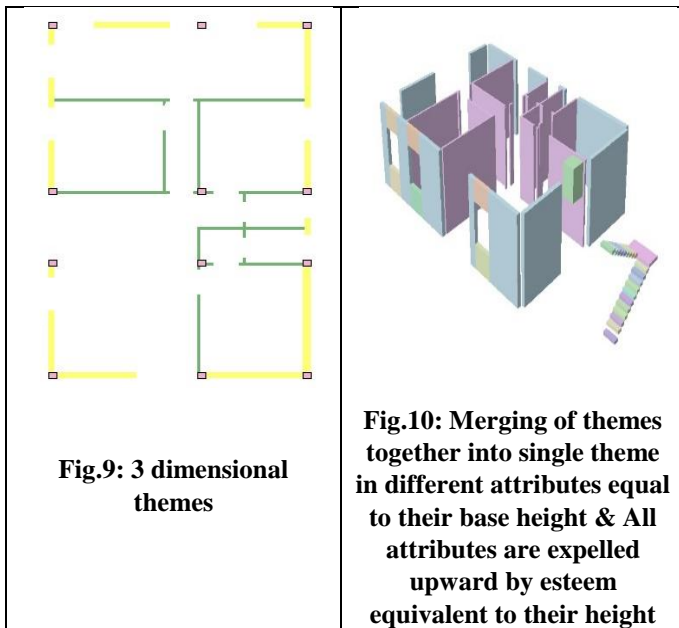
A few tools like P3 and Microsoft Project are used by the development business for booking purposes. The blend of these planning devices with GIS may be troublesome as a result of the need of coding inside different programming conditions. As the development propels, the system should be upgraded as often as possible and the scheduling calculations are completed numerous times on the changed data, which is a tedious procedure. In this manner, the Suggested methodology utilizes GIS to finish unique

tabular structure Modern et al. 1983) by utilizing in-house substance formed (in Avenue programming of ArcView). The proposed methodology for arranging in GIS creates a void table with a settled number of segments. The quantity of columns in the table relies on the amount of exercises in the framework. The substance requires action (movement delineation), from hub (harbinger occasion number, I), to hub (successor occasion number, j) and span (action time gauge) as responsibilities for every action through a multi-input talk box. The multi-input talk box embeds a line identifying with every action in the unfilled table. Finally, the last table gives starting and completing occasions, buoys, a criticalness of the varying exercises of the

framework. Furthermore, another substance to create singular timetable date choice (7-, 6-, and 5-day weeks) is utilized. This gives yield as day and date (for example Monday May 11, 2018). The default chart archive functionality in ArcView used to create the bar chart from the CPM planning.

**A. Themes Merging**

A new theme is created by sorting out at least two topics of comparative sort of geometry (e.g., focuses, lines, or polygons). The consolidating topics implement is utilized to combine the themes and it belongs to Geo-Processing extension present in Arc View. Thus, the one generated output theme is of more than one input themes. The fields of input themes are being encased in output theme. Output themes encases the fields from one of the input themes. On alike fields, at that point output themes' all fields *attribute table* populate. Something else, if any input of the rest has extra fields those won't be incorporated into output theme's (ArcMap10.2) attribute table. Fig. 9 depicts 3-dimensional input themes; and in Fig. 10, by using the tool merging themes together three themes are merged to one.



**Fig.9: 3 dimensional themes**

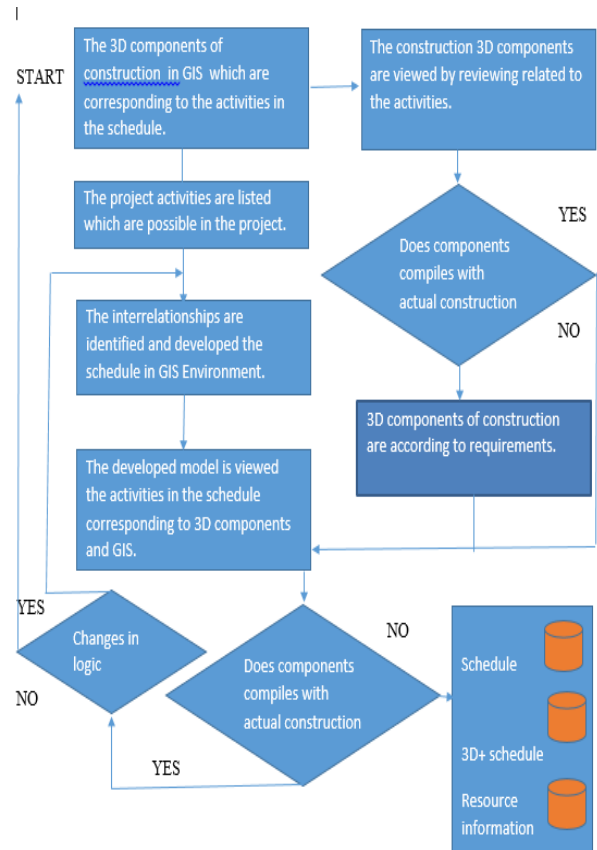
**Fig.10: Merging of themes together into single theme in different attributes equal to their base height & All attributes are expelled upward by esteem equivalent to their height**

**IV. METHODOLOGY**

**A. Construction schedule's visualization and assessment**

**Step 1: schedule**

It is a planning for executing project activities, and goes about like a guide for the effective execution. This progression includes recognizable proof of every single conceivable activity of the undertaking and acknowledgment of them between connections to orchestrate them in appropriate grouping. In this way, the building development project is deteriorated into various activities and the duration of each is evaluated. A content composed for the CPM figuring gets the recognized and presented in Fig.11.



**Fig.11: System for assessment and representation of the construction schedule.**

timing. It processes the undertaking length utilizing a CPM calculation. The yield table gives start/complete occasions, buoys, and criticalness of each task activity. The timescale that gives brisk outline for start and finish dates of an individual activities can likewise be produced. The parts relating to every activity the undertaking is connected to the CPM planning in light of the most punctual start time or most recent time of start.

**Step 2: 3dimensional components**

Spatial information of different activities open of the timetable is kept up in the data points, which shape the reason of GIS based recognition. It isn't imperative to have a 3-dimensional portion identifying with each action in the timetable. For model, in the precedent structures, segments development, inside dividers development, inner dividers development, section business related 3 dimensional parts. At any rate there should be movement in the timetable contrasting with each 3-dimensional portion. The amount of points made contrasting with each action (addressing its spatial perspectives) will depend on the dimension of detail to be given in the consequent model. For instance, in Fig.3 outer dividers indicated diverse sub activities in various topics by giving distinctive start/complete occasions for each. Another plausibility is to consolidate the sub activities spoken to by three unique subjects to make individual topic (aindividual3 dimensional part). The quantity of subjects to be built for every activity may likewise rely on the





geometry. For instance, in the example building, one topic will be sufficient to speak to the thickness of outside dividers change over the tallness, in this way, two distinct subjects speaking to these adjustments in stature made and converged into one to speak to in the outer divider work. So also, five unique subjects made in the superstructure are made at various dimensions of tallness to think about opening in various dividers. The topics relating to the activity's in the schedule can be surveyed by review them in 2 dimensional/3 dimensional. The segments are connected with the calendar in the event that they consent to the necessity, else they are reshaped. Once in a while unique subjects might be combined \_or split contingent upon the activity's characterized in the CPM plan produced in Step 1. For instance, in Fig.12, outside dividers is appeared three changed topics. On the off chance that the whole outside wall work is incorporated into individual activity of the CPM plan, three topics might be converted into an individual subject. The segments in a subject that has a place with a similar activity however are situated at various positions in the 3-dimensional space may likewise be gathered together. For instance, the lintels over the entryways and windows are not adjoining one another but rather can be assembled into an individual segment, relating to an activity of the schedule. After making the spatial perspectives comparing to an activity in the CPM plan, spatial data is explored by review the subsequent 3-dimensional segments. On the off chance that it conforms to the necessities, at that point the subsequent stage is pursued, generally the segments are altered.

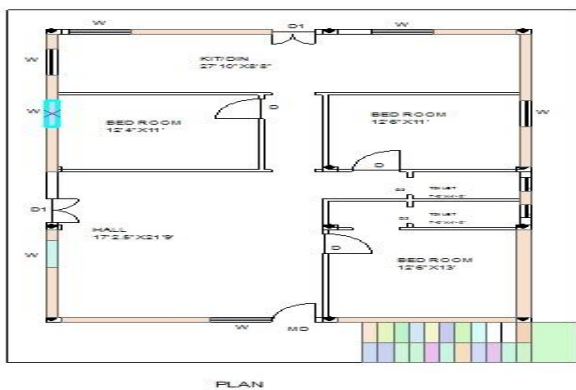


Fig. 12: Plan view of residential building (Drawn GIS)

**Step 3: Linking activities with corresponding 3 D parts.**

Interfacing activities with 3 dimensional portions gathers accompanying spatial perspectives made in Step 2 with the relating activities of the CPM plan gained in Step 1. The linkage between a fragment and a movement of the CPM calendar may not by and large be composed one section contrasting with activity of the timetable. In any case, a relationship like various to one may exist in which various parts identifies with activity in the calendar. In such a relationship, parts are joined and starting there associated with the looking at action. The one to various associating is also possible if there is an individual part identifying with various activities (Fig. 13.) Connecting incorporates including a field called Activity ID to the CPM plan and the

property table of each part either physically or then again by using a substance. The field Activity ID that is typical between the two tables i.e., CPM timetable and attribute tables of unmistakable segments is used to develop relationship between the parts and the looking at action. All segments in the field Activity ID are to be entered physically and should be unique in both the tables. In like manner, the credit required to relate the parts with the relating activities in the calendar are the entries in the field Activity ID of the property table of each portion and the timetable table. A substance is used to relate activity's in the calendar to the relating 3 dimensional portions. This substance in like manner lights up the customer about those activities in the arrangement that don't have relating 3 dimensional fragments and moreover gives a once-over of 3 dimensional parts without relating activity's in the calendar. After the relationship of activity's in the timetable to the looking at 3 dimensional fragments, the ensuing 4D model can be seen for its exactness

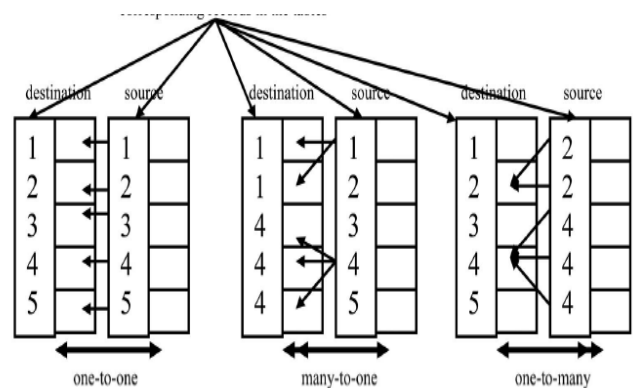


Fig. 13 Connections of the two tables connected up through field named activity ID used in this work

**Step 4: calendar Evaluation:**

This progression incorporates surveying the calendar to check the improvement game plan. A substance that makes the courses of action of the extensive number of dates i.e., beginning occasions being developed of the timetable is added to the Arc View. By tapping out on the town in the once-over, activity's that are needed to be in errand on, before that date will be graphically recognizable in 3 dimensional on the PC screen. The calendar for different dates can be surveyed by envisioning it in 3 dimensional through activities. The coordinators can have a movement of pictures to depict the environs of the improvement on a particular date. This movement may be a monotonous strategy yet it allows to research the substitute improvement plan as well. The system apparently confers the house improvement consenting to the timetable. In case the advancement gathering concurs with the perfect yield and does not require any change in the quantity of activity's and rationales, the CPM calendar will finally be recognized and no modification is allowed in this way

(Fig. 11). This step proposes the handiness of the GIS based methodology in recognizing the issues in the schedule.



### Step 5: Corrections of the Schedule

In the resulting model, the GIS based strategy appears at what time parts are to be made, where they will be in the space. It enables understanding a 3-dimensional view and the topological relationship between various parts from various perspectives like zooming, holder, fly forward or in transform, and so on. Ensuing to dismantling the model, on the off chance that it doesn't agree with the required headway assembling and needs a few changes in the technique for thinking (interrelationship among the activities), the CPM plan is changed again as shown by the fundamentals. All action's that are not in the social event should be adjusted in the CPM plan. All relationship among the actions in the CPM plan that contain a physical inconvenience or can cause authentic agitating impact or deferral at the building site should be adjusted at this stage. After use of the ideal changes, the timetable is again connected with the related parts for assessment and get-together insistence. It is at long last perceived whether no adjustment in the premise and number of movement's is required. In the event that the measures of action's in the timetable need improvement/cancellation or if some changing is furthermore required in the differentiating parcels, the whole system should be repeated.

### V. LEVEL OF DETAIL IN MODEL

By actualizing the suggested strategy in constructing residential listing, lacking of unique calendar was recognized and improvements are done. These are not examined because of the limitations on the size of the manuscript. In the event that few activities of the schedule not in detailed but constrained, the generated model does not share the development process in wanted successive way regardless of whether the schedule is right. For example, the activity door frames and windows work in superstructure is shown in fig.14 and fig.15 without and with sufficient degree of details respectively.

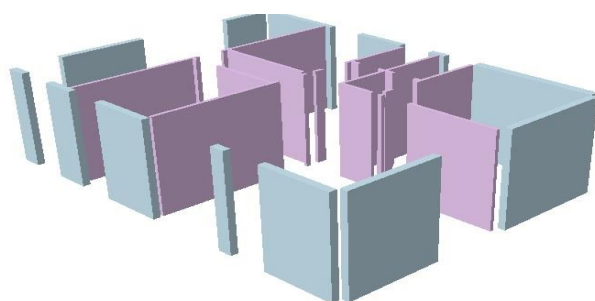


Fig. 14: Without adequate level of details

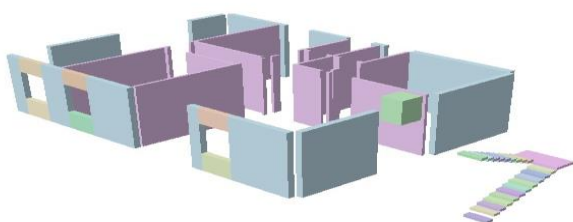


Fig. 15 Adjusted arranged schedule with adequate degree of details

### VI. CONCLUSION

This paper shows a GIS based technique to speak to and Coordinate spatial and non-spatial data, such as illustration, details, assets, and development plan for an individual situation. The different spatial tasks on designs and non-spatial activity on the property information in a GIS situation may enhance and accelerate the development arranging just as guarantee information honesty and exactness. The proposed technique incorporates the development plan with comparing spatial subtleties to make the task succession straightforward. GIS enables the client to control the schedule and 3D parts in a Single environs, which thusly encourages the fast age of options. The calendar in GIS permits less demanding comprehension of the task just as identifies conceivable issues in it. By incorporating and showing determination/suggestion and development asset data, the calendar in GIS advances association and cooperation among the undertaking colleagues from distinctive fields. GIS enables clients to utilize its database the board capacities to keep up and refresh the development database. Most of the 4D CAD technologies do not have the project management capabilities and are used mainly for the planning and design phase of the project. On the other hand GIS based developments can be used at any stage of the projects. The proposed philosophy bolsters extra examinations like rate examination, cost gauges, and permits incorporating wellbeing proposal with basic activities, in this way making the calendar increasingly reasonable. This investigation infers that GIS can be a valuable choice to extend computation tools like P3 and Microsoft Project. It permits even an unpracticed client to recognize inconspicuous issues in the CPM plan. Non-spatial schedules can just pass on what is fabricated "when", though the calendar in GIS passes on what is being assembled "when and where." The real end drawn from this explore is that GIS based improvements give a development plan representation tool as well as be utilized as a venture the project management tool at any phase of the undertaking in which the plan and the 3D parts can be controlled in an individual environment.

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