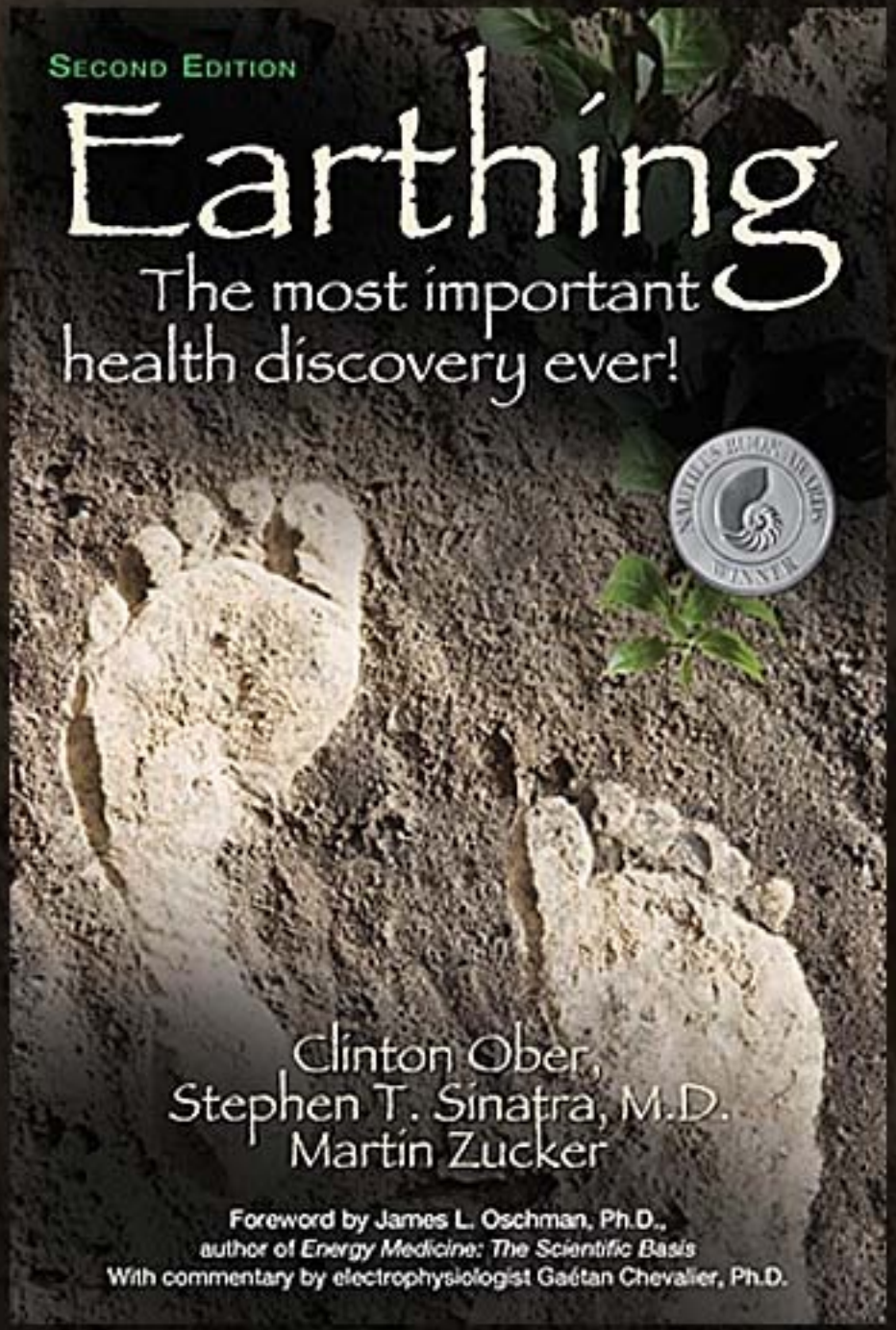
NetPoint + GPM
CONFERENCE
May 13 & 14, 2021



Schedule *Density Zooming*™

Machine Generating and *Navigating* Multilevel Schedules

Presented by:
Gui Ponce de Leon, PhD, PE, PMP
Founder/CEO
PMA Consultants LLC


Second Edition
Earthing
The most important health discovery ever!
Clinton Ober,
Stephen T. Sinatra, M.D.
Martin Zucker
Foreword by James L. Oschman, Ph.D.,
author of Energy Medicine: The Scientific Basis
With commentary by electrophysiologist Gaétan Chevalier, Ph.D.



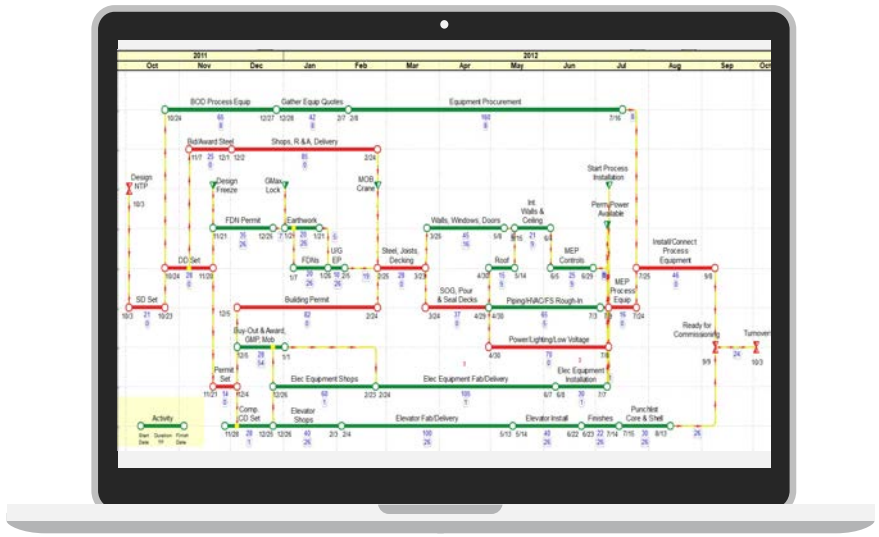
MEET THE PRESENTER

Gui Ponce de Leon, PhD, PE, PMP

Founder/CEO, PMA Consultants LLC

Dr. Gui started his career in 1969 while in grad school, facilitating scheduling sessions on a drawing board with Townsend & Bottum, Inc. project managers and superintendents. Dr. Gui has served as contractor chief scheduler, consultant, program manager, project manager, forensic scheduler, and expert witness, and he has pioneered innovations throughout his 50-year career. Dr. Gui holds 6 US patents and has numerous patents pending. He pursued MS studies at Vanderbilt and obtained his PhD from Michigan in 1972. From 1973-1989, he taught two graduate courses in scheduling in the Civil & Environmental Engineering Department in the College of Engineering at Michigan.

WHY We Do Scheduling Software



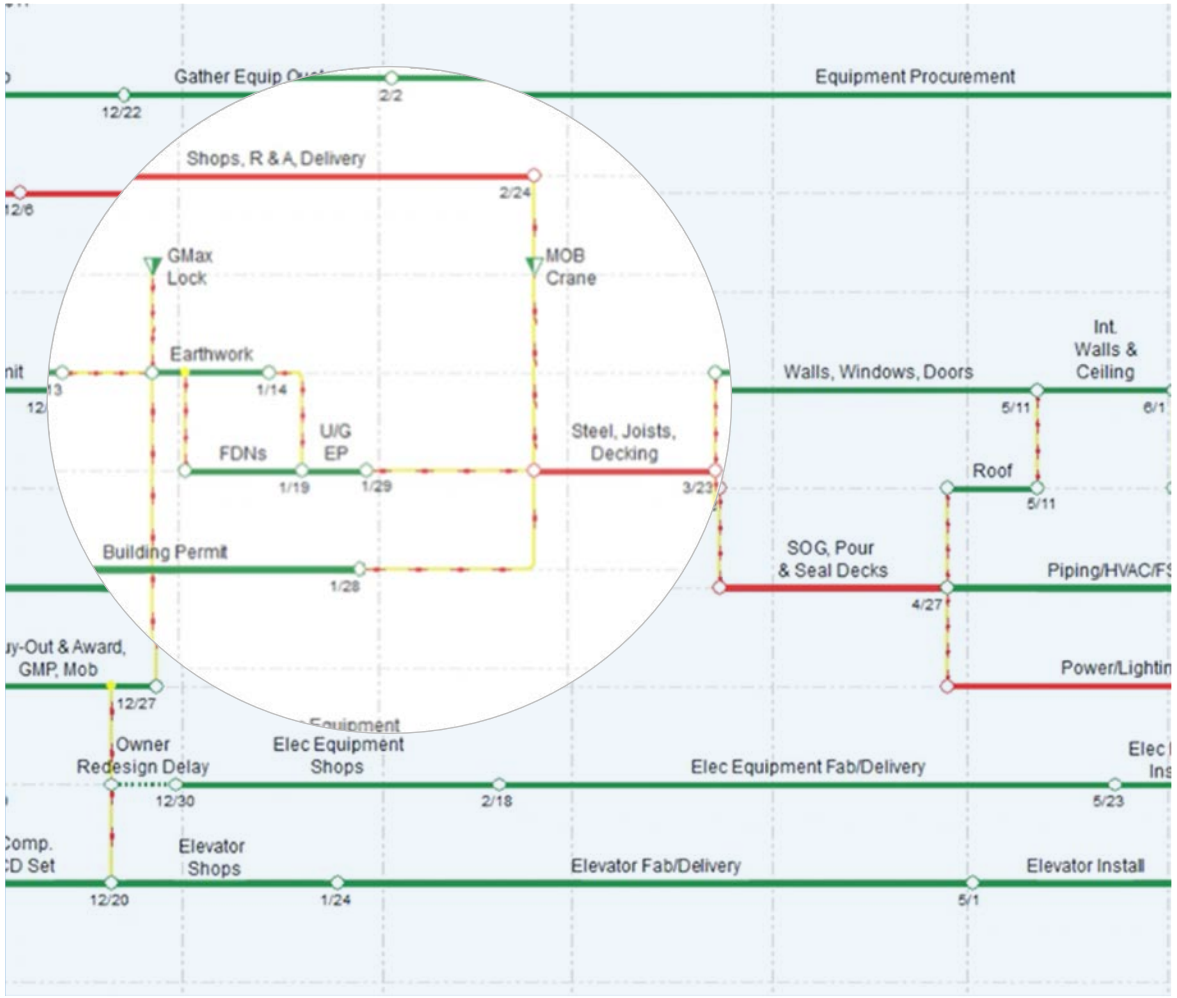
Because we believe that advancing scheduling software improves project predictability

GPM Scheduling Software Agenda

- Collaborative platform; stakeholders able to engage
- Return to time-scaled networks as schedule visuals
- Algorithmic, as-built network left of the data date
- Modeling *float-use risk* in schedule risk assessment
- Machine-generated *summarized* network schedules
- Fully achieve the *learning* potential of level 3 schedules
- As-built data augments scheduler's predictive acumen

Density Zooming™

Manually creating a summary network schedule from a massive P6 schedule is an arduous, time-consuming process. To solve this long-standing challenge, we introduce ***Density Zooming™***, an algorithmic protocol that machine generates and enables navigating multilevel, fully integrated schedules.



Scheduling Nightmare



A 2,000-activity contractor schedule is common on a project

Transit mega project schedules regularly exceed 10K activities



We Create Summarized Schedules When…

- Visually explaining schedule issues to stakeholders
- Building summary schedule models in risk assessments
- Engaging stakeholders in schedule recovery
- Attaching a one-page schedule in progress reports
- Performing as-planned vs. as-built delay analyses
- And so on and so forth…

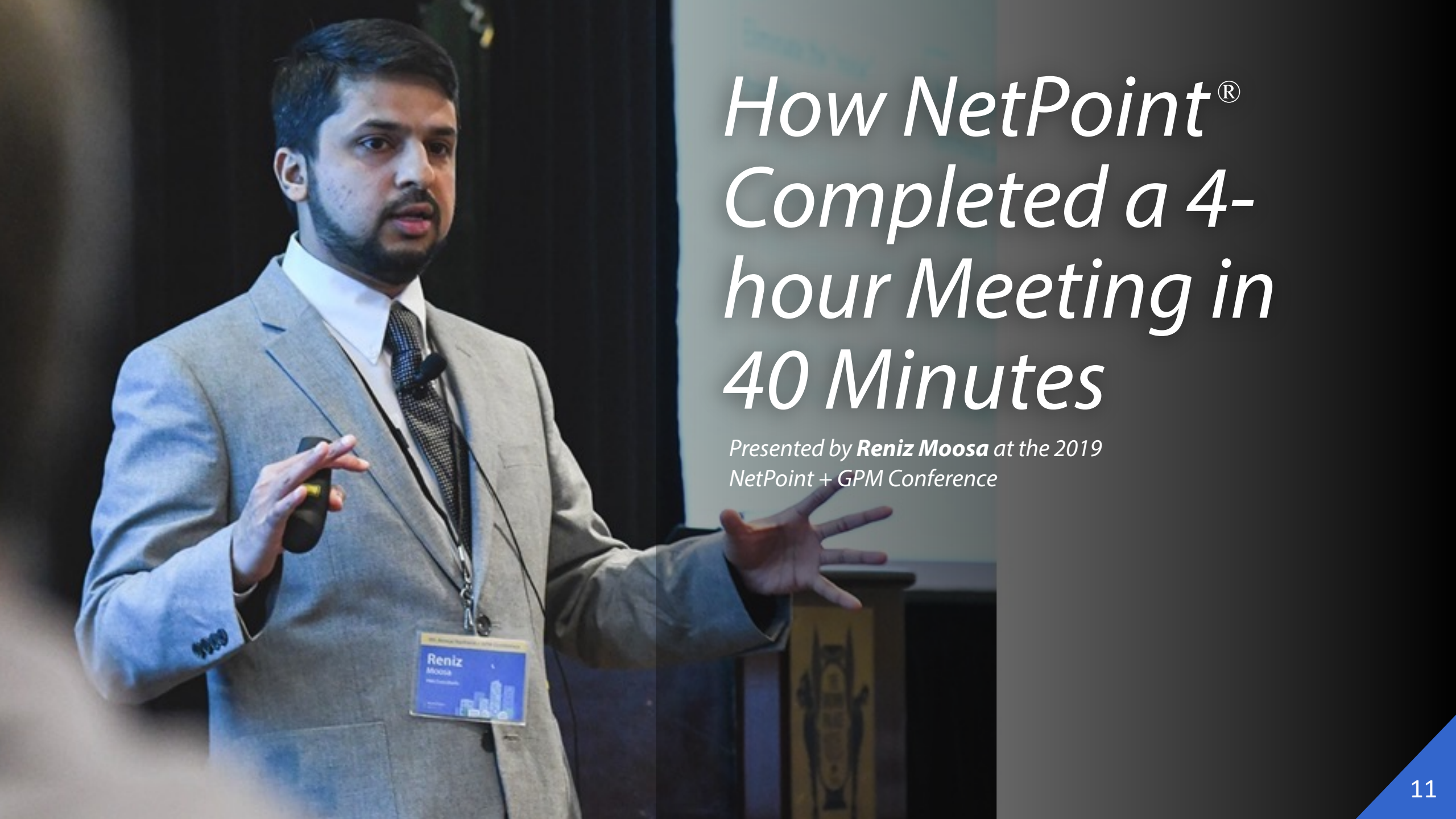
Massive Detailed Schedule



Summary NetPoint® Schedule

Schedule Summarization with NetPoint®

- While NetPoint® undeniably and greatly facilitates activity and logic summarization, it nevertheless takes an inordinate amount of time to *manually* ***summarize a network***, as it is an iterative process of tweaking bar grid, text, and date displays, and *summing up* logic



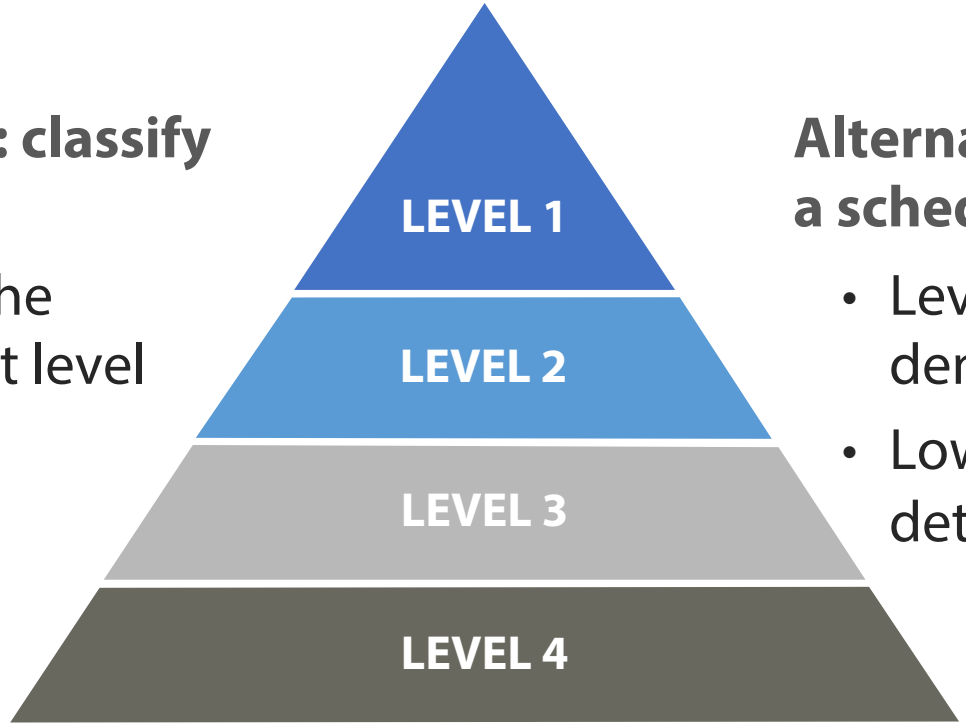
How NetPoint® Completed a 4-hour Meeting in 40 Minutes

*Presented by **Reniz Moosa** at the 2019 NetPoint + GPM Conference*

Level of Abstraction in Network Schedules

Conventional approach: classify a schedule by its *level*

- Level 1 at the top of the pyramid is the highest level
- Higher level means less detail



Alternate approach: classify a schedule by its density

- Level 1 is the lowest density
- Lower density means less detail

Level of Abstraction The amount of complexity by which a system is viewed or programmed. The higher the level, the less detail. The lower the level, the more detail. The highest level of abstraction is the entire system.

Strategic vs. *Tactical* Schedules



Level 1 & 2 *strategic* schedules are best built collaboratively

- One common characteristic is few activities repeat themselves



Level 3 *tactical* schedules are developed by schedulers (often with input from, but not partaking, stakeholders) to confirm the project scheduling strategy at the onset and as the project progresses

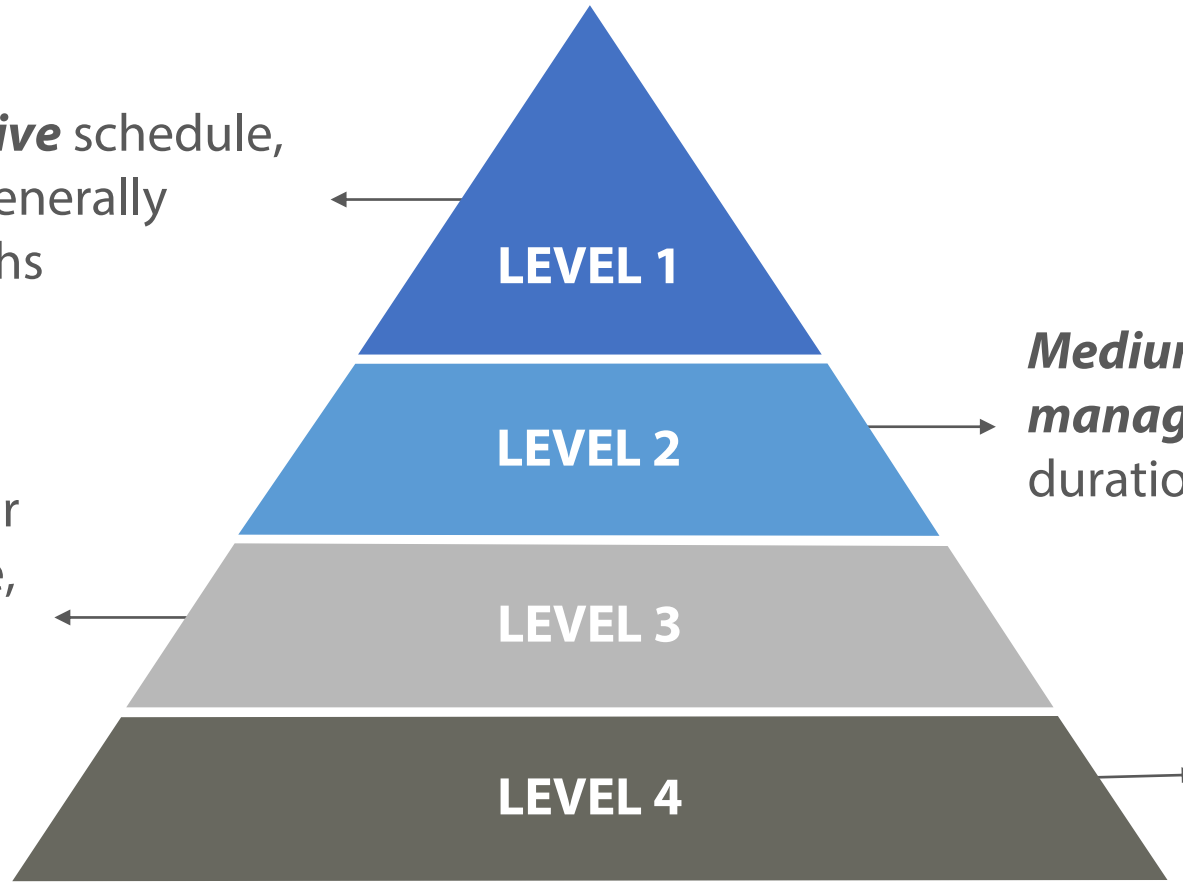
- Level 3 activity repetition opens the door to *machine learning*

Strategy defines your long-term goals and how you're planning to achieve them. ***Tactics*** are much more concrete and are often oriented toward smaller steps and a shorter time frame along the way.

Generally Accepted Schedule Hierarchy

Strategic vs. *tactical* schedules; activity durations are for construction phase, physical work

Low**-density **executive schedule, activity durations generally ranging 1.5-6 months



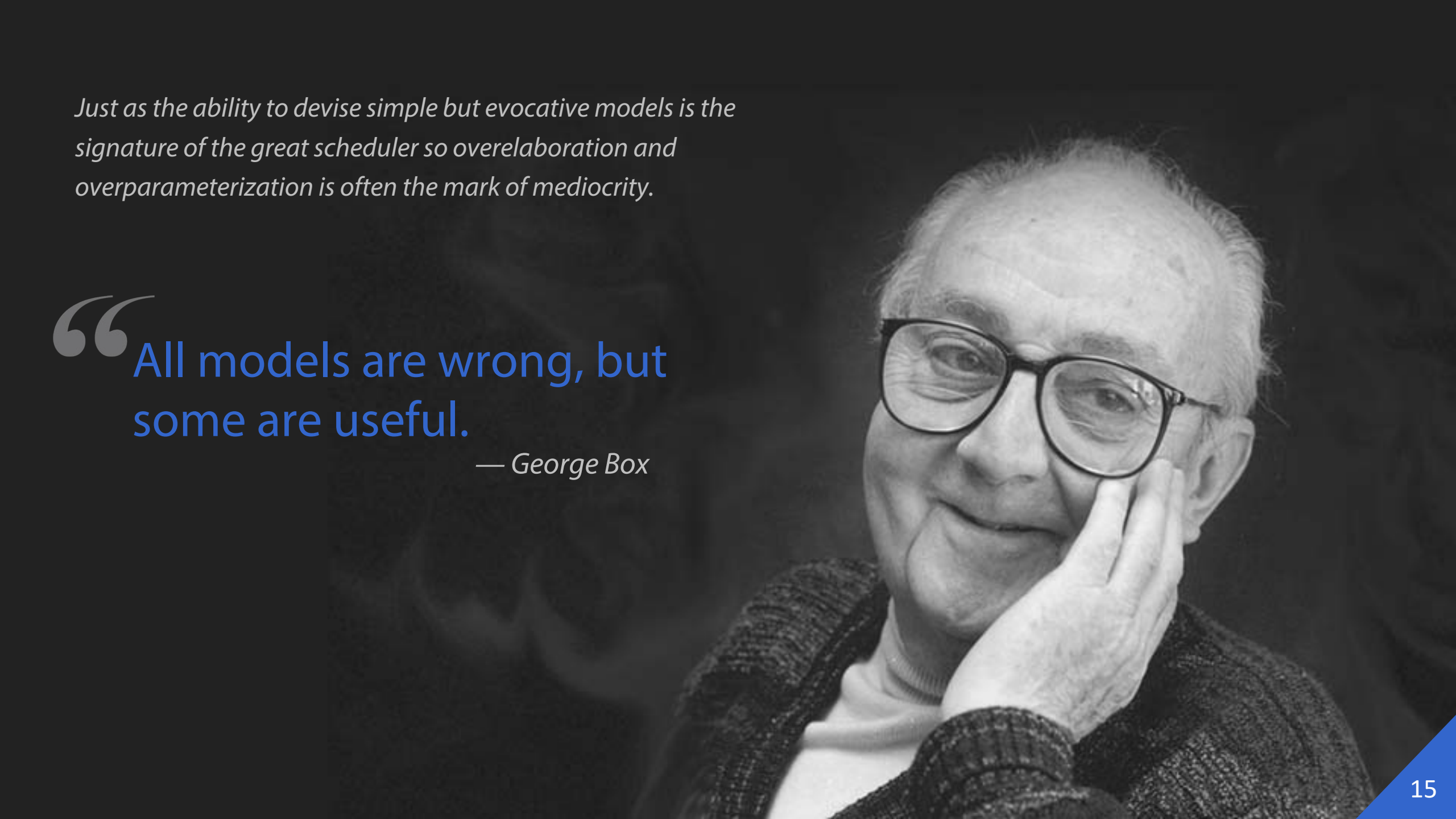
Medium**-density **master or management schedule, activity durations generally 3-15 weeks

High**-density **control or ***coordination*** schedule, activity durations generally 2-20 days

***Highest**-density* area or next 3-4 months' schedule, activity durations generally 1-10 days

Just as the ability to devise simple but evocative models is the signature of the great scheduler so overelaboration and overparameterization is often the mark of mediocrity.

> All models are wrong, but some are useful.
>
> — *George Box*



High-Density Level 3 Schedules

Level 3 schedules confirm sequencing strategy and level 2 activity durations/logic as planned and as the project progresses

- For construction contracts from $50M to $250M, 175-350 activities per $10M (i.e., 5,000 activities for $250M)

Accurate level 3 schedules rely largely on the attention and skill of the scheduler, software contributing only to record the model and to calculate a simulation using algorithms

- This only scratches the surface of future level 3 schedule accuracy and ***usefulness***



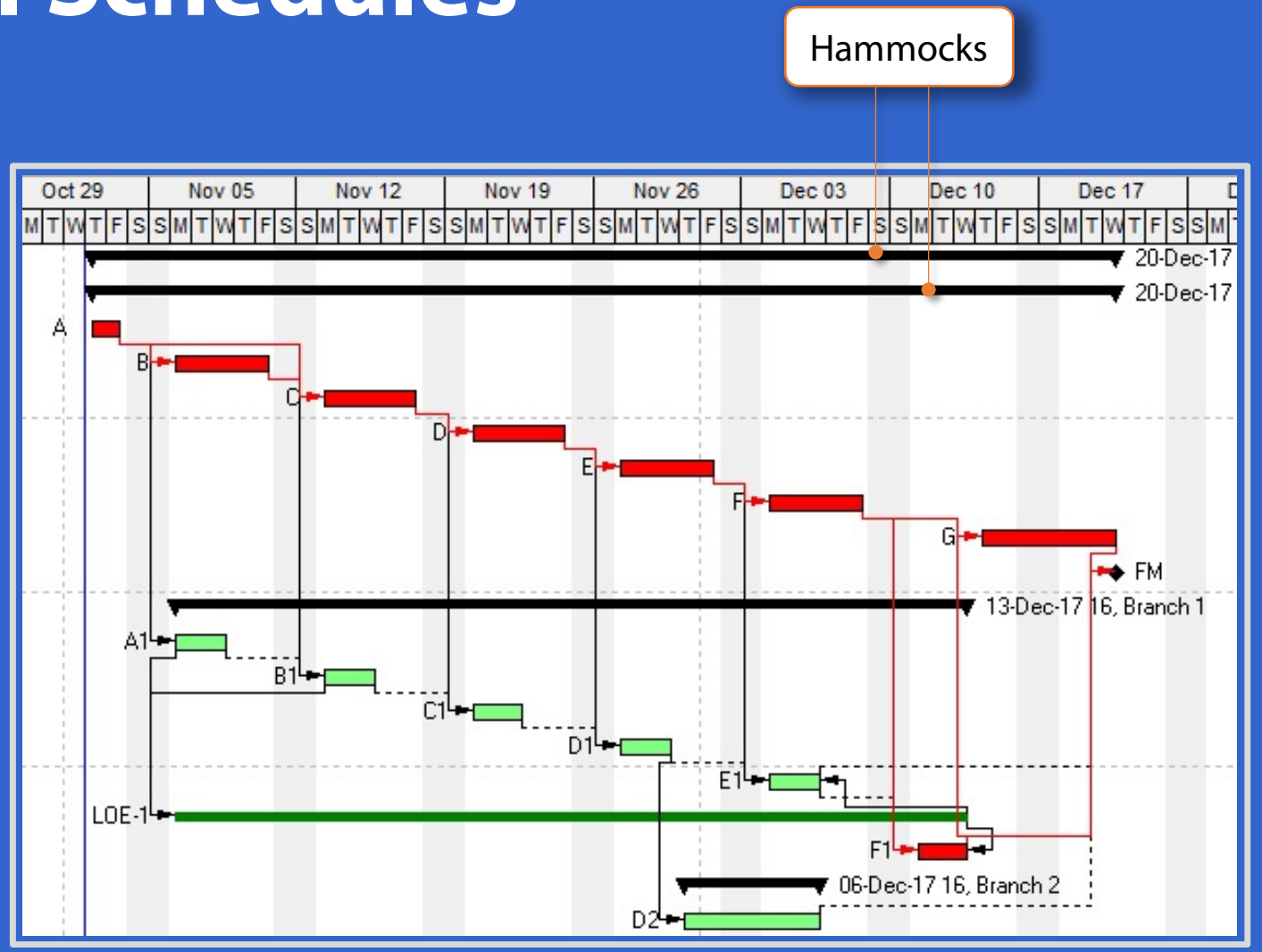
Pretender Multilevel Schedules

Hammock charts: a bar "hangs" between two dates

- CPM software functionality that rolls up activities to hammock complies with the requirement for vertical (date) integration

Hammock charts are schedule visuals without logic, thus, modifications or calculations ARE NOT possible

- As links DO NOT roll up to the (summarizing) hammocks, static hammock bar charts LACK horizontal traceability



Discovery: *Hierarchical Density Zooming*

From a *source* network schedule, *machine generate* aka *density zoom up* and keep in sync and transposable, a multilevel hierarchy of *vertically and logically* integrated network schedules, and *zoom out* and *zoom in* to view and navigate the ***concordant*** schedule counterparts



Sample synonyms for concordant: accordant, coherent, compatible, congruent, congruous, consistent, consonant, correspondent (with or to), harmonious

Concordant Multilevel Schedules

Multilevel schedules are *concordant* if integration and traceability extend beyond activity dates to include:



Logic ties and link gaps



Critical path/s and near-critical paths



Total floats



Relevant benchmarks and milestones

Hierarchical *Density Zooming*™



***Zooming up*:** machine generating and syncing a *summarized* aka *lower-density* schedule



***Zooming in*:** swapping the schedule displayed on the canvas to a *higher-density* counterpart

- e.g., switch from level 1 to level 3



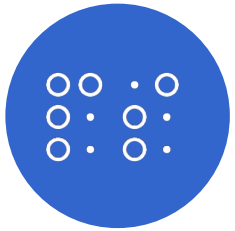
***Zooming out*:** swapping the schedule displayed on the canvas to a *lower-density* counterpart

- e.g., switch from level 3 to level 2

Hierarchical *vs.* Ad-Hoc *Density Zooming*



Hierarchical* zooming**–multiple ***concordant network schedules (e.g., schedule levels 1-4) are machine generated and coexist in one file and are kept in sync



Ad-hoc zooming–the machine generated *lower-density* schedule, generated from the entire or a part of the *source* schedule, is not intended for reuse

Density Zooming Up—Hierarchy Structure



***Express* summarizing routes to structure *zooming up*:**

- WBS packages, summarizing hammocks, or organizing codes, in each case designating a “swim lane” hierarchy

***Inferable* summarizing routes to structure zooming up:**

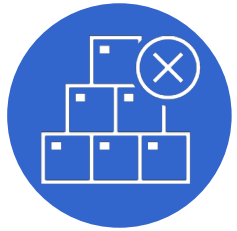


- Clusters selected interactively by the user in real time
- Clusters selected by the software based on *learned* features

Zooming Up—Activity Concordance



Each *source* WBS package, hammock, code, or cluster is a *parent* activity in the machine-generated schedule level



Source activity that sets a *parent* early start and a *parent* early finish is the parents' *start child and finish child* (in each case, least TF if a tie)

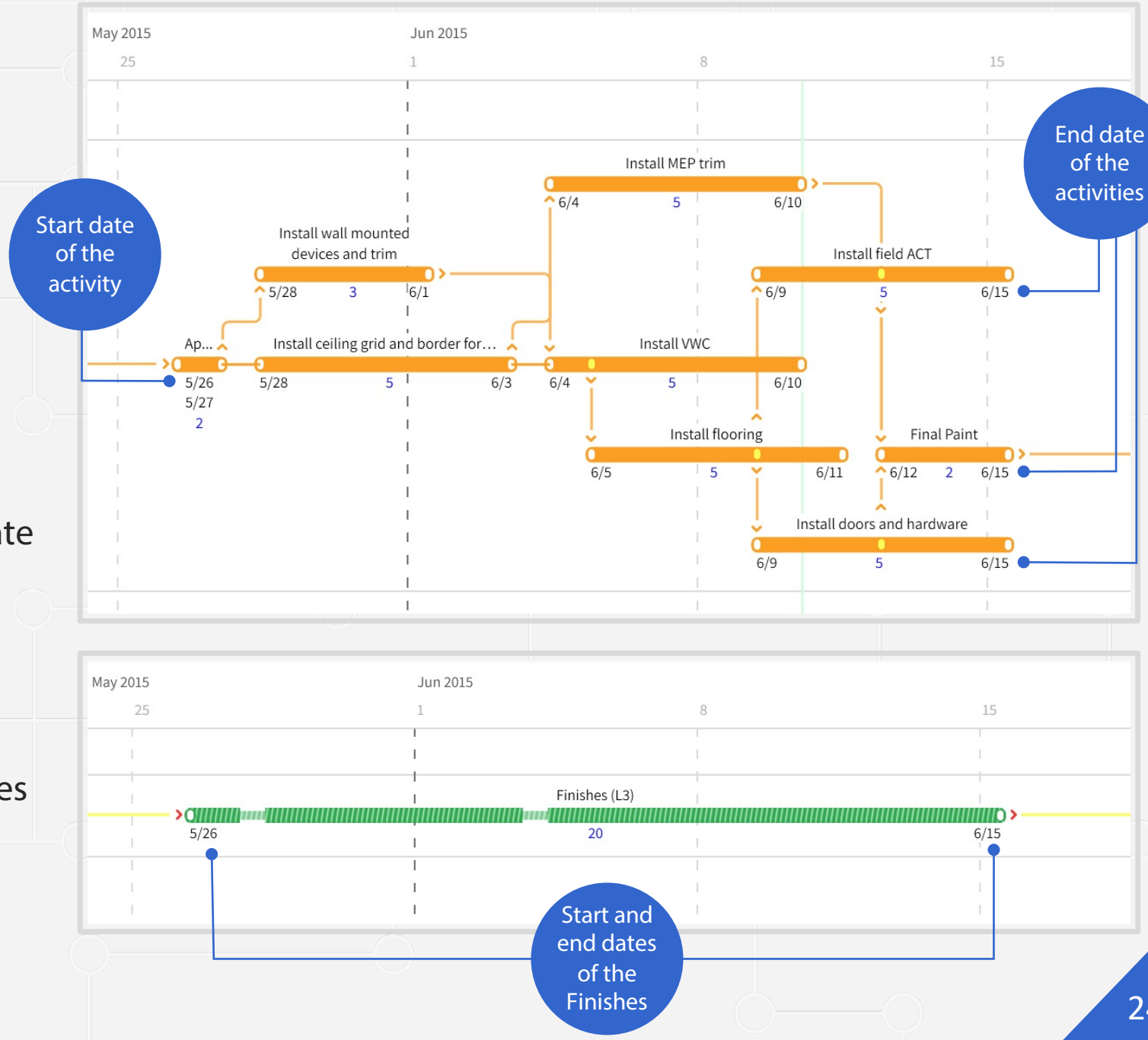


Source activity that is intermediate within a parent with lower TF than the *start child TF* and *finish child TF* is a ***middle child***

Zooming Up—Activity Concordance (cont'd)

Additional properties of *parent* activities:

- *Overall* duration from start date to finish date
- Net duration is overall duration less non-working periods
- Drift, float, total float, and, if a *middle child*, ***minimum*** float
- Left of the data date, actual start/finish dates and the GPM algorithms calculate forensic gap, drift, float, and total float and identify the current as-built critical path



Zooming Up—Logic Tie *Concordance*

- *A source* link *sums up* if a *parent's start* or *finish child* is linked to another *parent's start* or *finish child*

- *A source* link *sums up* if a *parent's child* is open-ended (not linked)

- Where a *child* is SS/FF linked to another *child*, the smaller gap link *sums up*

Zooming Up—Logic Tie *Concordance* (cont'd)

If start-to-finish (SF) links are to be avoided, a *sum-up SF* link is replaced by a *sum-up* FS link and a *sum-up* FF link

- *Sum-up* SF links naturally occur in 5 out of 12 *sum-up* logic patterns between a *start child* and a *finish child*
- A *sum-up* SF link occurs when a parent *start* or finish *child* is only linked to an *intermediate* activity in the *source* schedule

Zooming Up—Event *Concordance*

***Three* out of *six* possible event-activity logic ties in the *zoomed-up* schedule, with *sum up* gap = *source* gap**

- *Source* event preceding a *start child* is linked to the *parent* start
- *Source* schedule event succeeding a *parent's finish child* is linked from the finish of the *parent*
- *Source* event preceding a *finish child is* linked to a *finish* embed placed at the *source* start date of the *finish child*

Take-Aways

It is an arduous, let alone inexact, task to *manually* build a concise network schedule from a detailed schedule

Density zooming™ yields ***concordant*** multilevel schedules, a new standard for multilevel integration

With software powered by *density zooming* algorithms, PMA ends the search for a Holy Grail in scheduling

One More Thing—Schedule *Navigation*

Density Zooming **a schedule becomes as ubiquitous as pinch-to-zooming a map**

- View any two ***concordant*** schedule levels on a split screen
- As you pan on one, the other self-pans and keeps up

The graphical time-scaled schedule zooming poker hand:

- ***Density*** zoom up and zoom in/zoom out to swap schedules
- ***Screen*** zoom in/zoom out to change object/text magnification
- ***Calendar*** zoom in/zoom out to alter time scale ***selectively***
- ***Auto-density*** zoom when fragnets miniaturize/revert to relevant

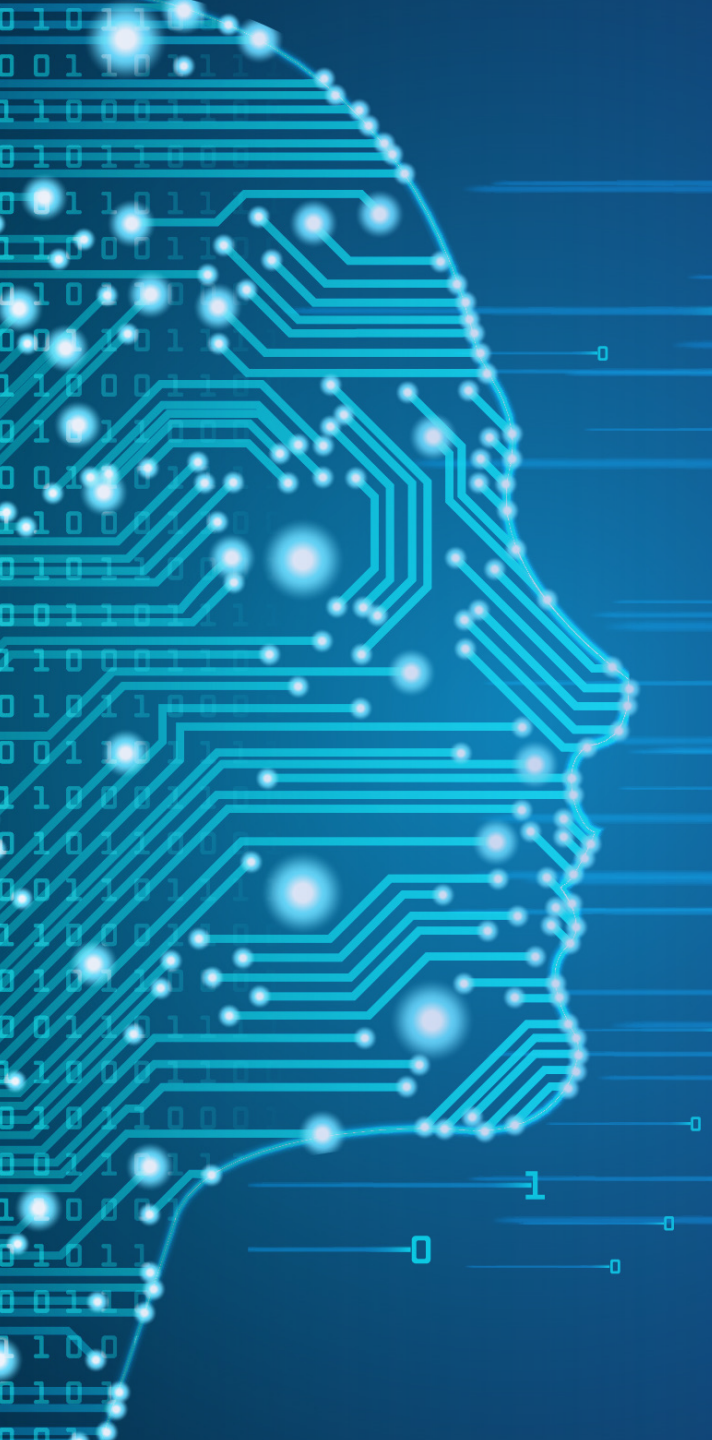
Auto-Density Zooming When Navigating

***Auto Zooming out* when compressing the timescale**

- Displayed fragnets within a swim lane, when no longer discernible, auto *zoom out* to the next *lower-density* detail

***Auto Zooming in* when stretching the timescale back**

- As the timescale allows previously *zoomed out activities or* fragnets to once again become discernible, *they zoom back in* to their originating (*higher-density)* level of detail



WHY *Next-Generation* GPM Software?

- Because we believe in a world where scheduling software engages and augments human intelligence
- Advances our vision of eliminating project overrun
- Accelerates our quest to produce reliable project schedules that are understood by everyone
- Makes visualizing/navigating large schedules effortless
- Automates creating/updating multilevel schedules
- Repurposes level 3 as ***machine-learning*** schedules

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