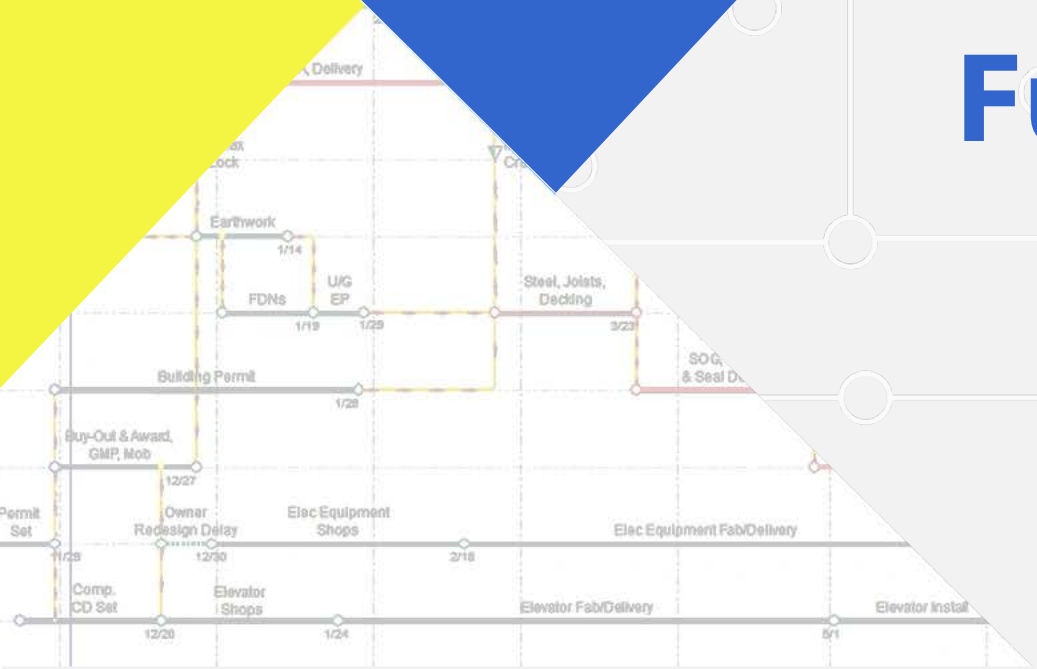
NetPoint + GPM
CONFERENCE
May 13 & 14, 2021



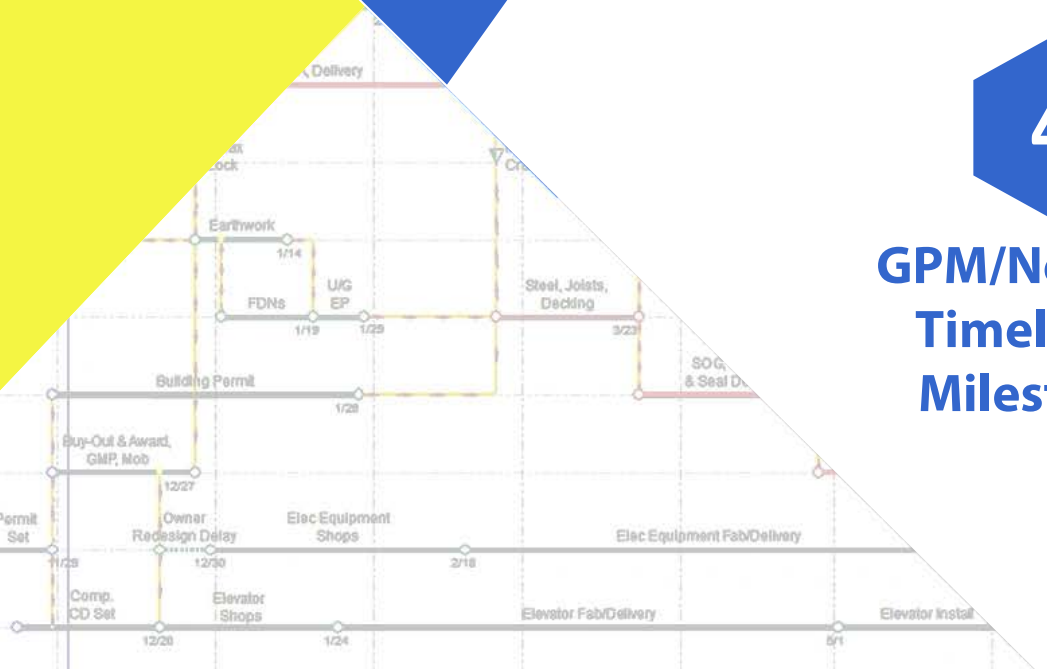
Developmental History & Future of NetPoint & GPM

Presented by:
Tim Mather, PMP, LPEC, CCMP | **Vivek Puri**, PhD | **Liang Liu**, PhD



AGENDA

1. **History of Network-based Planning/Scheduling**
2. **Stakeholder-Centric Scheduling**
3. **GPM Core Concept & Innovation**
4. **GPM/NetPoint Timeline & Milestones**
5. **Future Development & Plans**
6. **Q/A**





This presentation retraces the developmental history of **NetPoint** and the **Graphical Path Method** (GPM).



Since the development of the underlying Logic Diagramming Method and its initial unveiling at the **2008 PMICOS conference** in Chicago, a dedicated team of software engineers, designers, programmers, and practitioners has implemented the mathematical underpinnings of **NetPoint** to enable planners to produce a logic-driven schedule while collaborating interactively with all stakeholders. Inspired by the need to prioritize visualization and real-time adaptation to change, **GPM** remains true to its origins.



New **ideas** and **discussions** of innovative functionalities are highly encouraged.



MEET THE PRESENTER

Tim Mather PMP, PMI-ACP, CCMP, LPEC

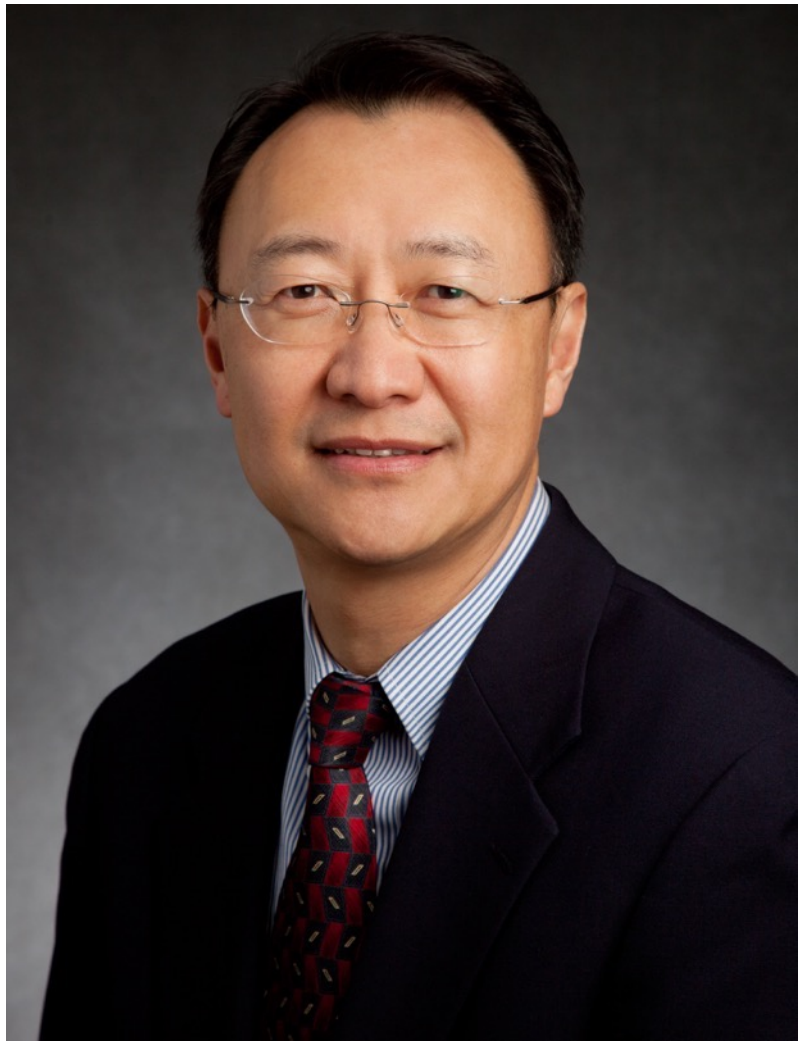
As COO of PMA Technologies, Tim is driving adoption of GPM and NetPoint. Tim is a PMP and PMI-ACP with an extensive background in project management, software development, and executive leadership. Tim earned his bachelor's degree from Michigan State University and pursued postgraduate study of project management at the University of Chicago.



MEET THE PRESENTER

Vivek Puri, PhD, PMP

Dr. Vivek Puri has significant experience with planning and executing projects in both construction and information technology areas. Dr. Puri's recent work involves research and development relating to NetPoint, NetRisk, and Schedule MD, three innovative tools developed in-house by PMA. His doctoral work was in the area of simulation applications for construction planning.

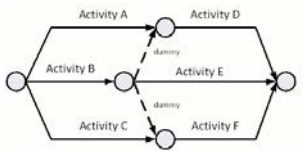


MEET THE PRESENTER

Liang Liu, PhD

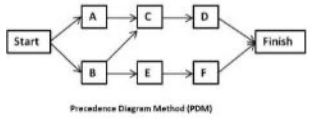
Dr. Liang Liu was a faculty member of the Construction Engineering and Management Program of the Department of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign from 1992 to his retirement in 2019. He was one of the core members of the GPM and NetPoint development team in 2004, contributing to the design and coding (in C++) of NetPoint software architecture, data structure, network algorithms, and the interactive GUI (graphical user interface).

NETWORK-BASED SCHEDULE DISPLAY PLATFORMS



1957–1997

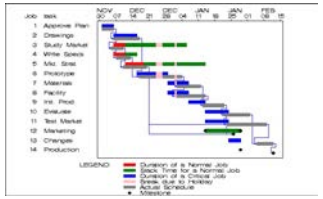
Schematic arrow diagramming method (ADM)



Precedence Diagram Method (PDM)

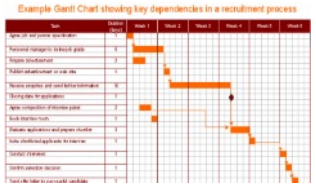
1963–2003

Schematic precedence diagramming method (PDM)



1983–2023

CPM-to-Gantt charts with PDM logic ties


Example Gantt Chart showing key dependencies in a recruitment process

1983–2023

Logic Gantt charts with simple dependencies

2008–Indef.

Logic diagramming method (LDM)



A CENTURY'S WORTH OF GANTT CHARTS:

Mid-1910s Henry Gantt creates Gantt charts as a tool for production scheduling in the job shop environment.

1931 Construction begins on the Hoover Dam using Gantt charts.

1956 The Interstate Highway System begins construction; Gantt charts are used as the scheduling method.

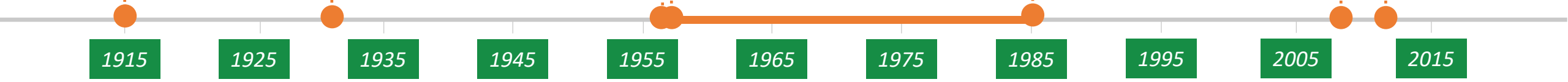
1957 CPM improves on Gantt charts by expressly recognizing the logic ties or dependencies between activities.

1957 to mid-1980s Gantt charts survive CPM as one of the formats often used to display CPM schedules.

Mid-1980s Gantt charts with logic ties aka Logic Gantt charts become the CPM software graph of choice.

2008 Dr. Gui introduces the graphical path method or GPM at the PMI College of Scheduling Annual Conference in Chicago.

2012 Patrick Weaver debunks the notion that bar graphs were invented by Gantt.



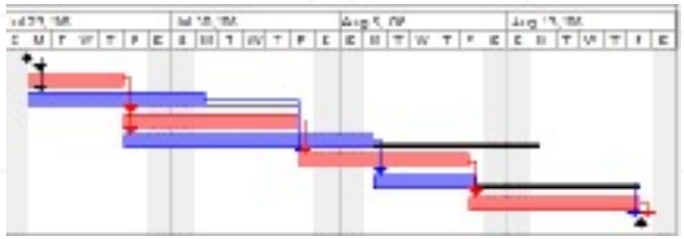


PLANNING & SCHEDULING METHODS



1885

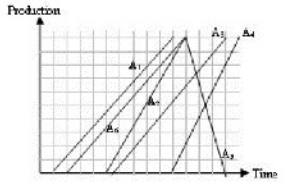
Frederick Taylor pioneers the Scientific Management movement.



1917



Wallace Clark, a colleague, credits Henry Gantt with what Clark called the “Gantt chart.”



1941

Line of Balance Method developed to handle new military production programs

1951

The Milestone Method is developed by the US Navy after World War II

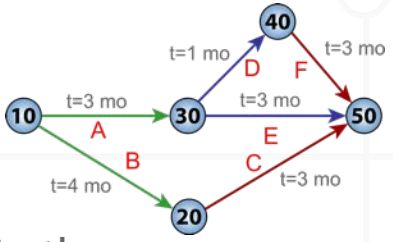
1957

Basic work by Kelley and Walker on CPM

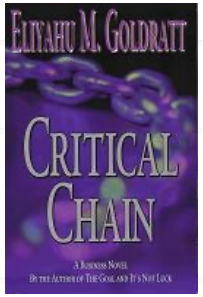




1958

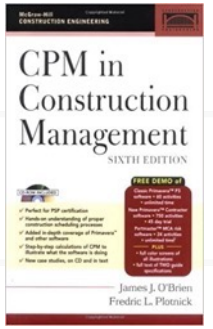


PERT is developed in the Navy's Special Projects Office for the Polaris Submarine & Missile program



1997

Critical chain is introduced in Goldratt's book, *Critical Chain*



2006

RDCPM, a variant of CPM, is introduced in the 6th edition of *CPM in Construction Management*



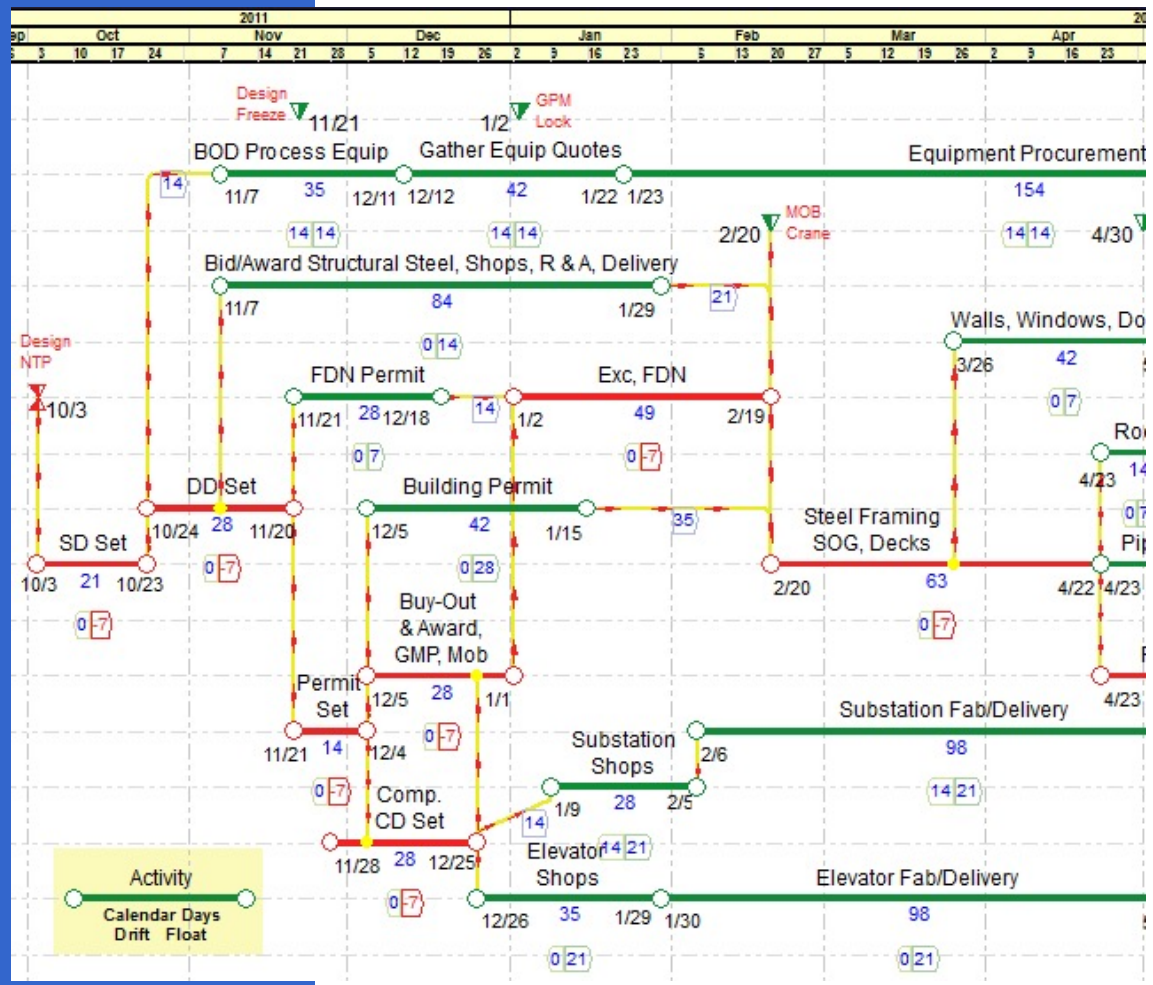
2008

Graphical Path Method is introduced by Dr. Gui at the PMICOS Conference in Chicago

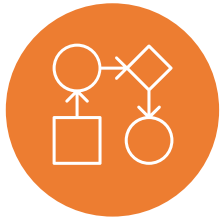
GRAPHICAL PATH METHOD (GPM) DEFINED

Planning/scheduling method anchored on object-base principles and rooted in network-based algorithms active on either side of the data date.

GPM algorithms are planned-date- biased, gap/drift/float calculators, from which total floats and early and late dates are derived.



BETTER SCHEDULING ALGORITHMS



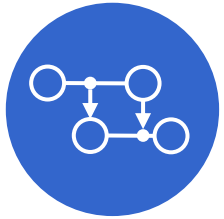
CPM Scheduling Algorithms

1957-1959 vintage, inapt for surface computing and ineffectual for randomized solutions



GPM Algorithms

2004-2009 vintage, better suited for planning and scheduling and for randomized schedule solutions



GPM Scheduling Algorithms

Gap–based, not date–based, self-healing, total floats left of the data date, push and/or pull planning



GPM Schedule Risk Algorithms

Each iteration is a progress simulation, floating is allowed, early & late completion risk, safe float



Network Layout Authoring Algorithms

Improve layout by utilizing strategies to optimize object locations under layout and aesthetic constraints

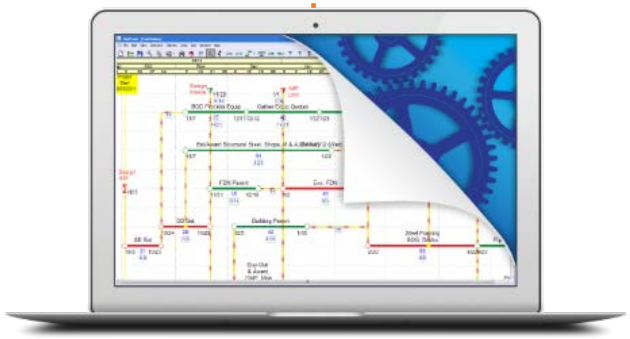


What the Future Holds

Countless algorithms genetically suitable for cloud and surface computing and for AI schedule solutions

GRAPHICAL PATH METHOD (GPM)

The graphical path method (GPM) is similar to the critical path method (CPM) but embodies a simpler scheme of thought in ways CPM cannot.



CPM scheduling algorithms were developed in **1957-1959** and remain unchanged.

GPM algorithms were initially developed in **2004-2009** and continue to be expanded.

1960 1970 1980 1990 2000 2010 2020 2030

CPM VS. GPM ALGORITHMS

for Randomized Schedule Solutions

1963

In **1963**, Van Slyke introduced a CPM simulation method to provide a schedule randomized solution that corrects for the PERT underestimation from merge bias.

Van Slyke's sampling method applies the CPM forward & backward pass in every iteration, thus ignoring the fact that early dates are unrealistic execution dates.

2016

In **2016**, Ponce de Leon and Puri proved that CPM simulation underestimates completion risk and introduced a simulation that relies on statistical sampling of the as-built schedule.

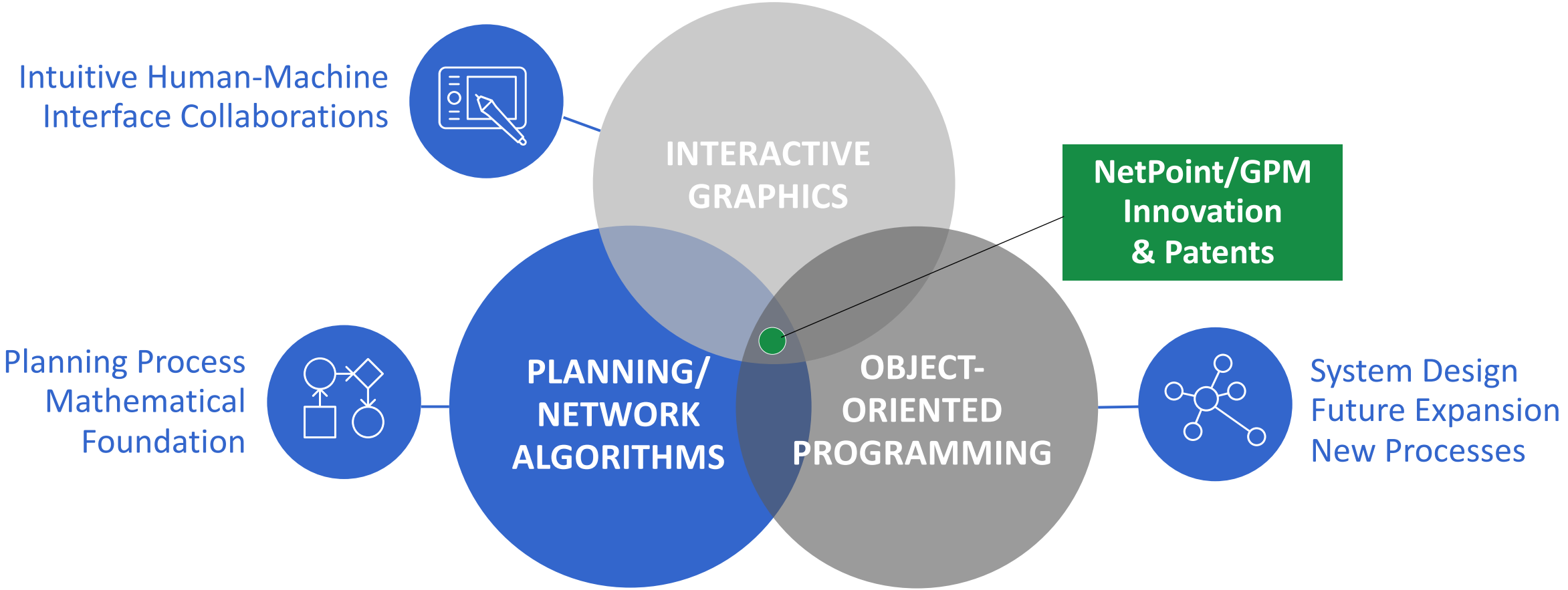
*GPM risk algorithms determine early **and** late completion distributions, and predict safe float–extent of total float that may be used and not delay the targeted p-value date.*

Introducing GPM at the **2008** PMI College of Scheduling 5th Annual Conference in Chicago

"This new process, GPM, better facilitates planning and scheduling by making it a hands-on, planning-dominated process. GPM allows project managers, superintendents, key subcontractors and other stakeholders to collaboratively, in one session, network a project by graphically positioning activities on a time scale, using a variety of simple and intuitive logic ties to convey activity relationships."



CORE OF GPM/NETPOINT INNOVATION

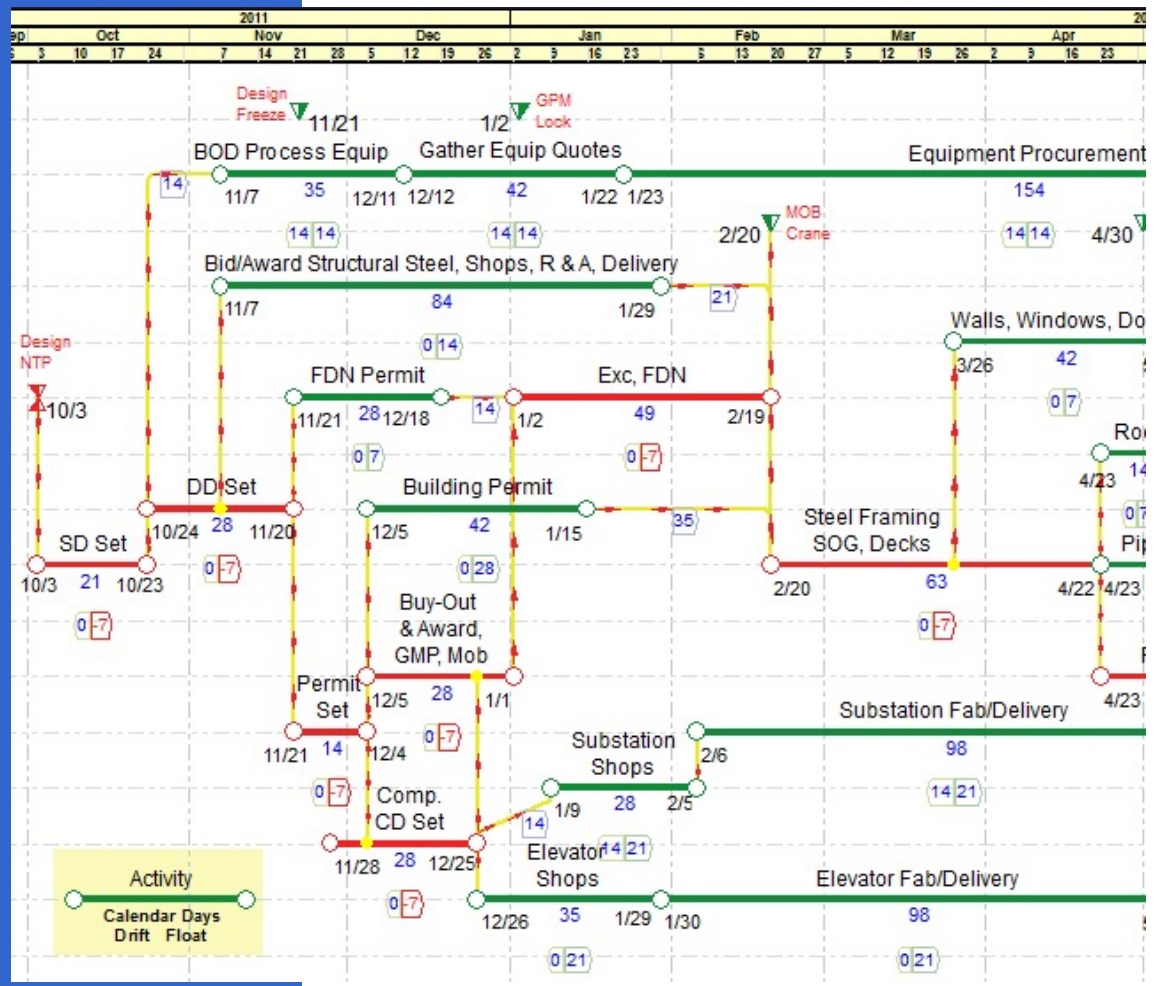


NETPOINT INTERACTIVE GRAPHICS & DESIGN

Behind the Scenes Walk-thru of NetPoint Object Interactions & Message Passing

Data Structures and Algorithms for Network Calculations, Costs, Resources, and Risk Management

Reports, What-if Scenarios, Data Exchange, and System Integrations



HISTORY OF STAKEHOLDER-CENTRIC SCHEDULING

1960s

Stakeholders engage via collaborative processes. Focus is on neat logic diagram, often time-scaled. “Logic rules, dates serve” paradigm.



1970s

Increased reliance on mainframe computing and Gantt charts, less on logic diagrams. CPM takes hold. The rise of the *CPM guru*.

2011 - Beyond

Emergence of symbiotic partnership between stakeholders’ thinking and objectbase graphics computing brings back the planning-centric process of the 1960s.

1980 - 2010

Planning takes a back seat to the calculation power of the PC. “Dates rule, logic serves” paradigm. Stakeholders disengage.

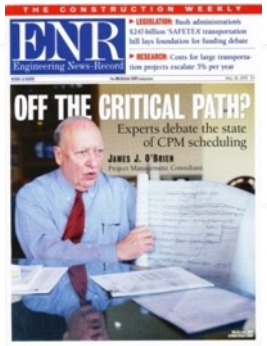


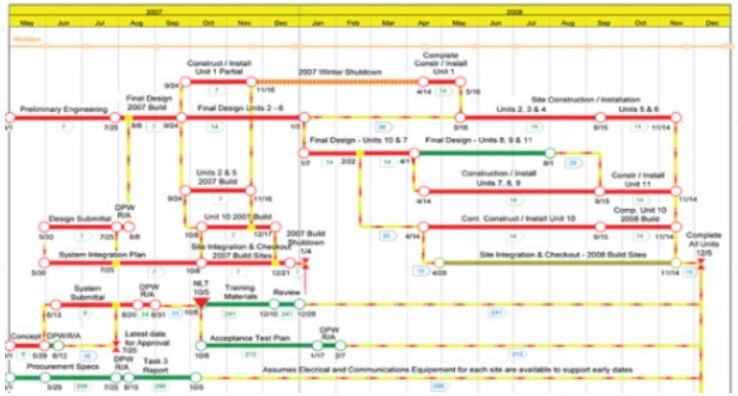
GPM TIMELINE

2003–2017

2003

May 26 *ENR* article “Critics Can't Find the Logic in Many of Today's CPM Schedules” is published.





2004

The seminal **May 2003** *ENR* article spurs the development within PMA of a computer graphics, event-driven planning and scheduling application rooted in algorithmic & planned dates, total floats, & the critical path.

2006

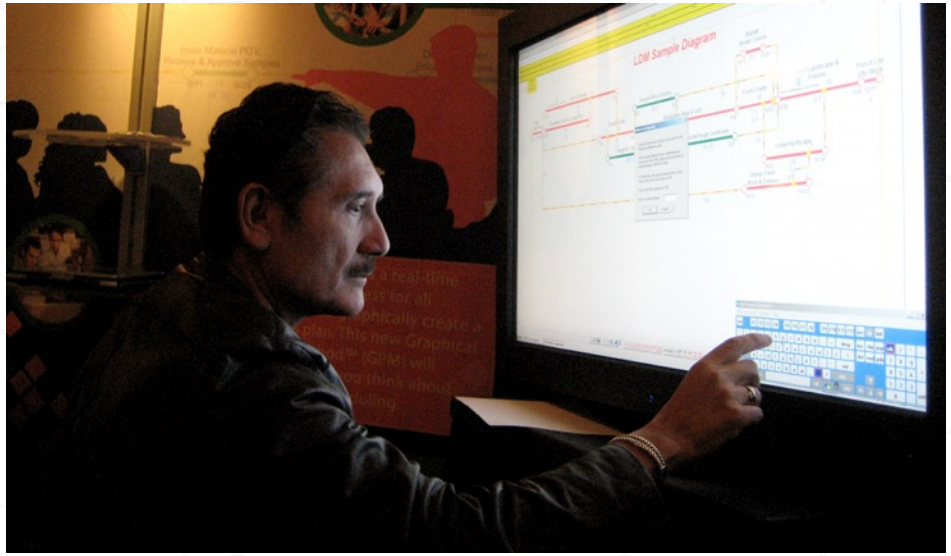
In **October**, PMA internal document discloses graphical method for simultaneously planning, scheduling, and presenting activities, events, and their relationships in a hybrid arrow and precedence network format in a manner easily understandable to schedulers, other professionals, and even to laymen.

2007



PMA files **first** patent application for a new network-based planning/scheduling process, which came to be known as the graphical path method or GPM.

2008



- GPM self-healing algorithms enabling a kinetic planning/scheduling user interface are developed by Dr. Ponce de Leon.
- Dr. Ponce de Leon introduces the basic GPM planning/scheduling scheme of thought at the PMICOS 5th Annual Conference in Chicago.
- Email conveying Jim O'Brien's favorable peer review of the initial academic paper on GPM states: "To me, the loss of the logic diagram has been the unrecognized tragedy in the evolution of CPM scheduling and your GPM brings it back full circle."
- Gilbane purchases the first NetPoint license sold on October 10, 2008.

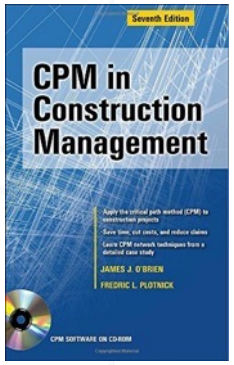
2009

GPM forensic total float is introduced at the PMICOS Annual Conference in Boston.



In the first quarter, a Top 20 Contractor in the *ENR* Top 400 Contractors List licenses 12 copies of NetPoint.





O'Brien & Plotnick's 7th ed. of *CPM in Construction Management* cites NetPoint as providing "superior graphics for managing a project."

2010

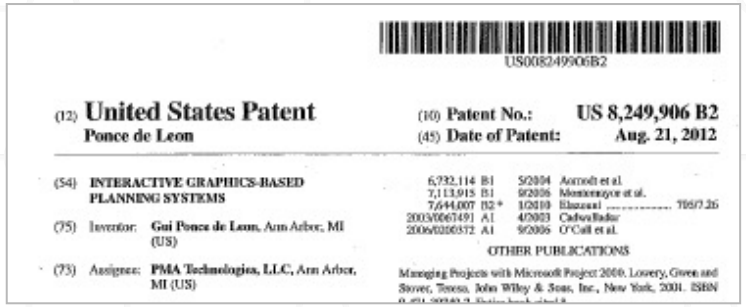
2011

NetPoint v4.0 is introduced at the First NetPoint User Conference in Orlando, FL.



2012

First GPM patent is awarded by the USPTO in August.



US008249906B2

(12) **United States Patent**
Ponce de Leon

(10) **Patent No.: US 8,249,906 B2**
(45) **Date of Patent: Aug. 21, 2012**

(54) **INTERACTIVE GRAPHICS-BASED PLANNING SYSTEMS**

(75) Inventor: **Gui Ponce de Leon**, Ann Arbor, MI (US)

(73) Assignee: **PMA Technologies, LLC**, Ann Arbor, MI (US)

6,732,114 B1 5/2004 Aamodt et al.
7,113,915 B1 9/2006 Montemayor et al.
7,644,007 B2 * 1/2010 Elazouni 706/7.26
2003/0067491 A1 4/2003 Cadva Radar
2006/0200372 A1 9/2006 O'Call et al.

OTHER PUBLICATIONS

Managing Projects with Microsoft Project 2000, Lowery, Green and Stover, Teresa, John Wiley & Sons, Inc., New York, 2001. ISBN

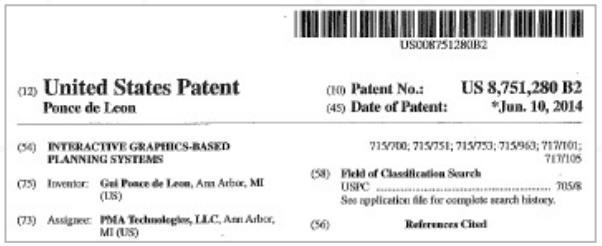
2013

GPM Risk and its software embodiment NetRisk v1.0 are introduced at the NetPoint & GPM User Conference.



2014

4th GPM patent is awarded by the USPTO in June.



US008751280B2

(12) **United States Patent**
Ponce de Leon

(10) **Patent No.: US 8,751,280 B2**
(45) **Date of Patent: *Jun. 10, 2014**

(54) **INTERACTIVE GRAPHICS-BASED PLANNING SYSTEMS**

715/700; 715/751; 715/753; 715/963; 717/101; 717/105

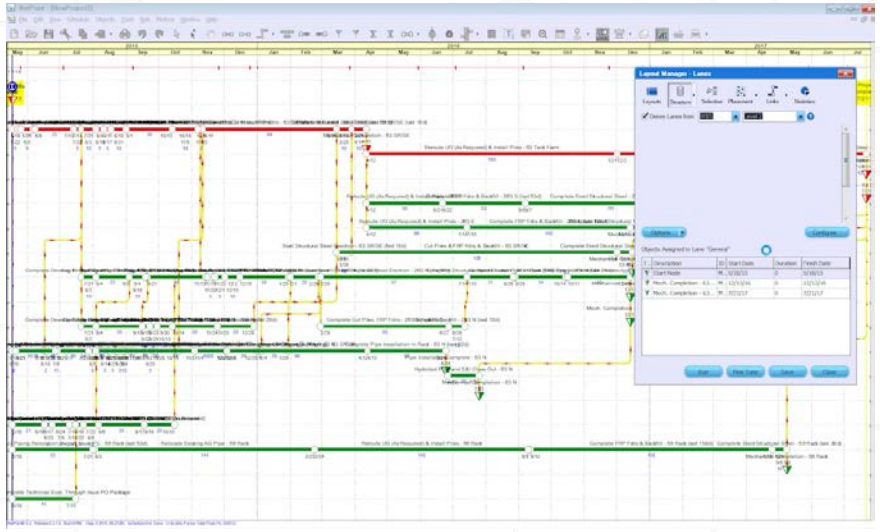
(75) Inventor: **Gui Ponce de Leon**, Ann Arbor, MI (US)

(58) **Field of Classification Search**
USPC 705/8
See application file for complete search history.

(73) Assignee: **PMA Technologies, LLC**, Ann Arbor, MI (US)

(56) **References Cited**

In April, a top 10 EPC contractor on the *ENR* Top 400 Contractors List orders its 37th license of NetPoint.

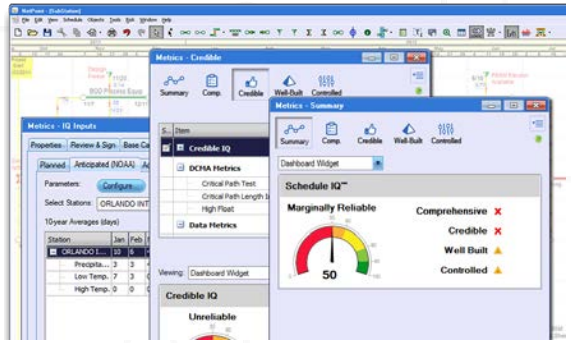


AutoGRAPH, NetPoint's constraint-based network layout authoring method, is introduced at the NetPoint & GPM Conference.

2015

NetPoint v5.0 unveiled at the NetPoint & GPM Conference.

the NETPOINT&GPM Conference 2015
January 13&14 - San Diego



2017

ScheduleMD v1.0 released as part of NetPoint v5.2.

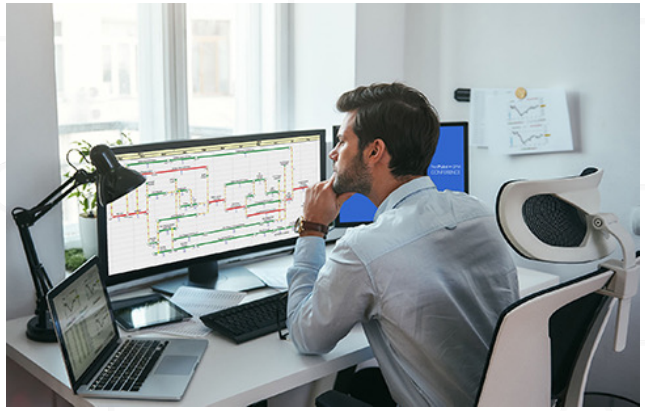
2020

NetRisk v3.0 rewritten and released with integrated cost risk analysis.

Development begins on the next generation platform for GPM planning/scheduling.

2021

Next generation GPM planning/ scheduling platform previewed at the NetPoint & GPM Conference.

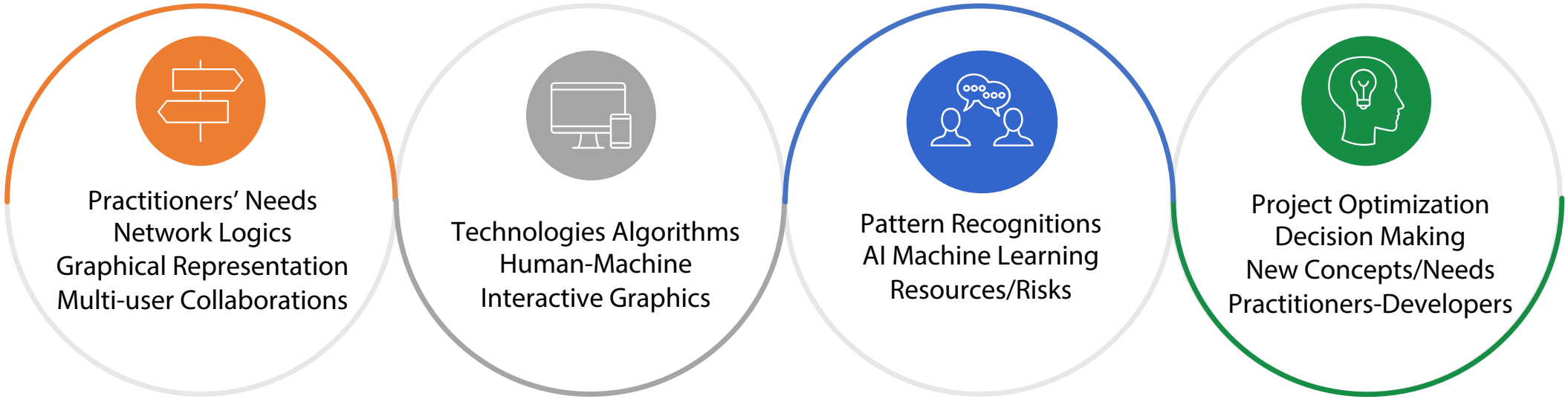


2022 +

Next generation GPM planning/ scheduling platform released.

GPM planning/scheduling leverages AI to solve key problems heretofore unsolved.

EVOLUTION OF NETPOINT DEVELOPMENT CYCLE



From Practitioners

With Practitioners

By Practitioners

For Practitioners



Q & A Time

Please type your questions
in the CHAT text box



Thank You

Users and creators of
GPM & NetPoint!