From DBR to Simplified-DBR

Eli Schragenheim
elyakim@netvision.net.il

Outline

- **A historical perspective.**
- **What to change?**
- **What to change to? The toolkit of S-DBR.**
- **When S-DBR would not fit?**
- **Just a little about how to cause the change.**

GOLDRATT schools

TOC ICO

Learning from the development of concepts

- **As TOC has significantly progressed since its initial development in 1985 – there must be something we can learn from the way ideas were formed.**
- **That initial verbalization was largely based on the OPT thoughtware that was developed in the early 80s.**
  - **Realizing software in itself does not change people's mind.**
- **Since then TOC has expanded its scope**
  - **TP, CCPM, Marketing and Sales and lately also Strategy and the concept of the ever-flourishing organization.**

Learning from the development of concepts

- **Few years ago some important changes to TOC in Manufacturing were introduced.**
  - **It is beneficial to understand the shift of ideas and especially the change in the focus.**
  - **The first shift, from OPT to DBR, happened before the TOC and the five steps were verbalized.**
  - **Then buffer management was introduced.**
  - **Then the DBR technique has shifted to S-DBR.**
  - **Then came the development of make-to-availability.**
  - **All those shifts can be characterized as becoming simpler, and also by moving from detailed planning to setting the priorities right.**

OPT was all about planning!
Execution meant simply following the schedule

- **Planning means making decisions ahead of time.**
  - **Which makes some decisions more vulnerable to Murphy.**
  - **There must be a reason for a specific decision to be taken at the planning session.**
    - **Most detailed plans suffer from frequent changes in the execution phase.**
  - **So, what decisions should be included in the planning?**
  - **and what should be left for the execution?**

GOLDRATT schools

From OPT to DBR

- **DBR was developed as a departure from OPT, which was an early and very sophisticated advanced planning and scheduling software.**
  - **Eli Goldratt realized the need to be simple with very clear rationale.**
  - **The emerged understanding backed the idea that there was no need for software.**
- **The detailed planning (finite capacity scheduling) was limited to just one resource.**
  - **None of the other resources were scheduled.**

From OPT to DBR

- **Buffers were added to protect the sequence of the capacity-constraint-resource (CCR) and the timely shipment to the client.**
  - **Three buffers were used:**
    1. **The CCR buffer protecting the detailed schedule of the CCR.**
    2. **The shipping buffer protecting the delivery dates. The CCR schedule had to ensure there is enough shipping buffer.**
    3. **The assembly buffer was required to ensure that materials that do not go through the CCR would be released on time.**

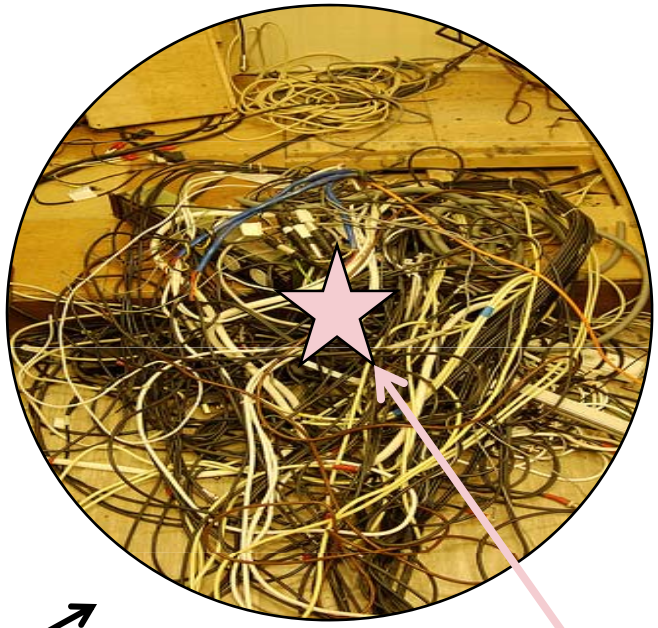
GOLDRATT schools

TOC ICO

The main insight of TOC

Fluctuating market demand

A complicated shop floor



Raw materials

List of orders

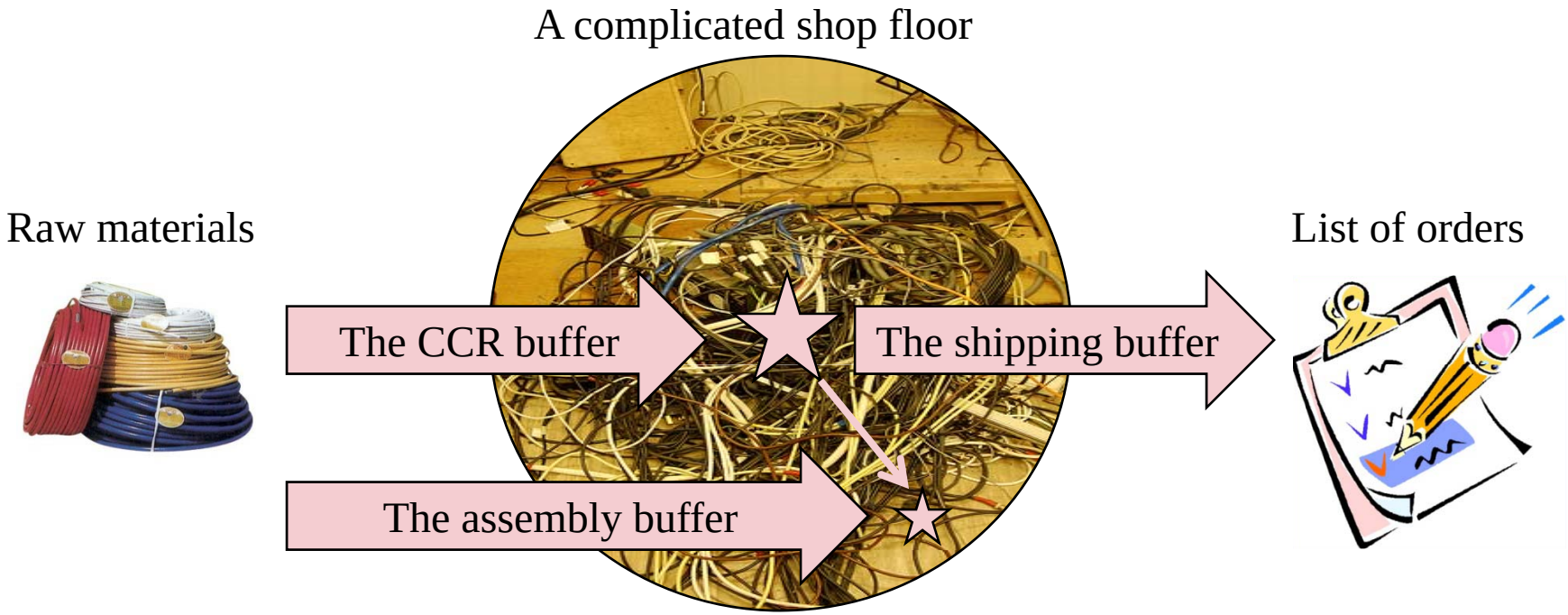
Murphy

The critical insight of TOC is that only ONE bottleneck or capacity-constraint-resource (CCR) really governs the performance of the whole system

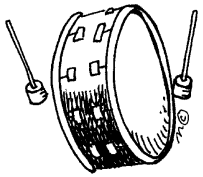
GOLDRATT schools

TOC ICO

The buffers in traditional DBR



The Drum-Buffer-Rope (DBR) planning



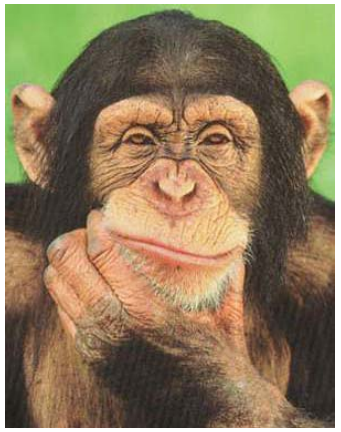
- **The Drum is the schedule of the CCR based on the orders at hand.**

- **Buffer is a protection mechanism to keep the drum from disruptions.**
  - **Buffers became a critical part of the planning.**

- **Rope is the raw materials schedule – forcing the choke of the release.**
  - **Preventing too much WIP.**
- **All in all DBR represented a huge simplification of the planning.**

The appearance of Buffer Management

- **In the early days of DBR there were no guiding rules for the execution phase.**
- **Then Eli Goldratt developed the idea of Buffer Management to dictate the priorities in execution.**
  - **Monitoring the actual consumption of the time buffer.**
  - **Dividing it to the three colors: Green, Yellow and Red.**
    - **Management should intervene only to flow red orders out.**
- **It took time for us to understand the contribution of Buffer Management.**
  - **Especially its impact on the distinction between planning and execution.**



GOLDRATT schools

TOC ICO

Two conceptual challenges at traditional DBR

1. **Should the constraint lie in the market demand or inside the organization?**
   - **It was assumed we cannot have both at the same time.**
   - **At the time the thinking was that the strategic constraint is under better control when it is inside the organization.**
2. **Suppose we do have an active CCR – is there a need to schedule it in detail?**
   - **What is the damage if the sequence is not kept?**

GOLDRATT schools

The relationships between the internal capacity and the market demand

- **The price we pay for having an internal capacity constraint:**

  - **Delivery times are relatively long.**
    - **Because of the wait time at the CCR.**
  - **Due-date performance is threatened.**
    - **Any interruption on the CCR itself puts the rest of the orders in the queue at a certain risk.**
  - **Fact of life: clients are not interested that their supplier has a bottleneck - when they feel their deliveries are compromised they look elsewhere.**

Changing the focus to be on the demand – the immediate ramifications

- **Focusing on the market demand is target to achieve the following:**
  - **Expanding the current (potential) demand.**
  - **Charging higher price for higher value.**
    - **For instance, by delivering faster and/or more reliably.**
    - **Making the shorter and reliable delivery valid at all times!**
- **Being able to focus on the demand requires protective capacity even on the "weakest link" itself!**
  - **Actually it means the CCR has to subordinate to the market demand!**
    - **Meeting the commitments at all times.**

Challenging the technique of traditional DBR

- **The damage of scheduling the CCR:**
  - **Inflexibility in dealing with urgent requests and other changes in priorities.**
    - **Rescheduling causes changes to many orders.**
  - **The scheduling process itself is batch oriented.**
    - **Orders wait to be scheduled.**
  - **Scheduling the CCR for make-to-availability is especially damaging because of the inflexibility it imposes.**
- **Maintaining three different buffers is difficult to implement and it creates conflicts in priority.**

Challenging the technique of traditional DBR

- **What prevents us from deciding upon the exact sequencing of the CCR in the last minute?**
  - **We need to know when to release the orders.**
    - **Providing enough time to be delivered on time.**
    - **Providing enough time to ensure the CCR is not starved.**
  - **We like not to waste too much capacity of the CCR.**
    - **Do we lose the precious capacity of the CCR if the CCR deviates from the sequence?**
    - **Only when the CCR is subject to strong sequence-dependent-setups there is a waste of capacity of the CCR.**
- **Note, the CCR-Buffer protects the sequence on the CCR – not just preventing starvation.**

The direction of the solution

- **The necessary ingredients of the solution for make-to-order:**
  - **The planning is able to link between the need to meet all the commitments to the market and having enough capacity of the CCR.**
  - **There is one time buffer per order.**
    - **The focus in the execution phase is definitely on the market demand.**
    - **There is one clear list of priorities based on the color code of green-yellow-red.**

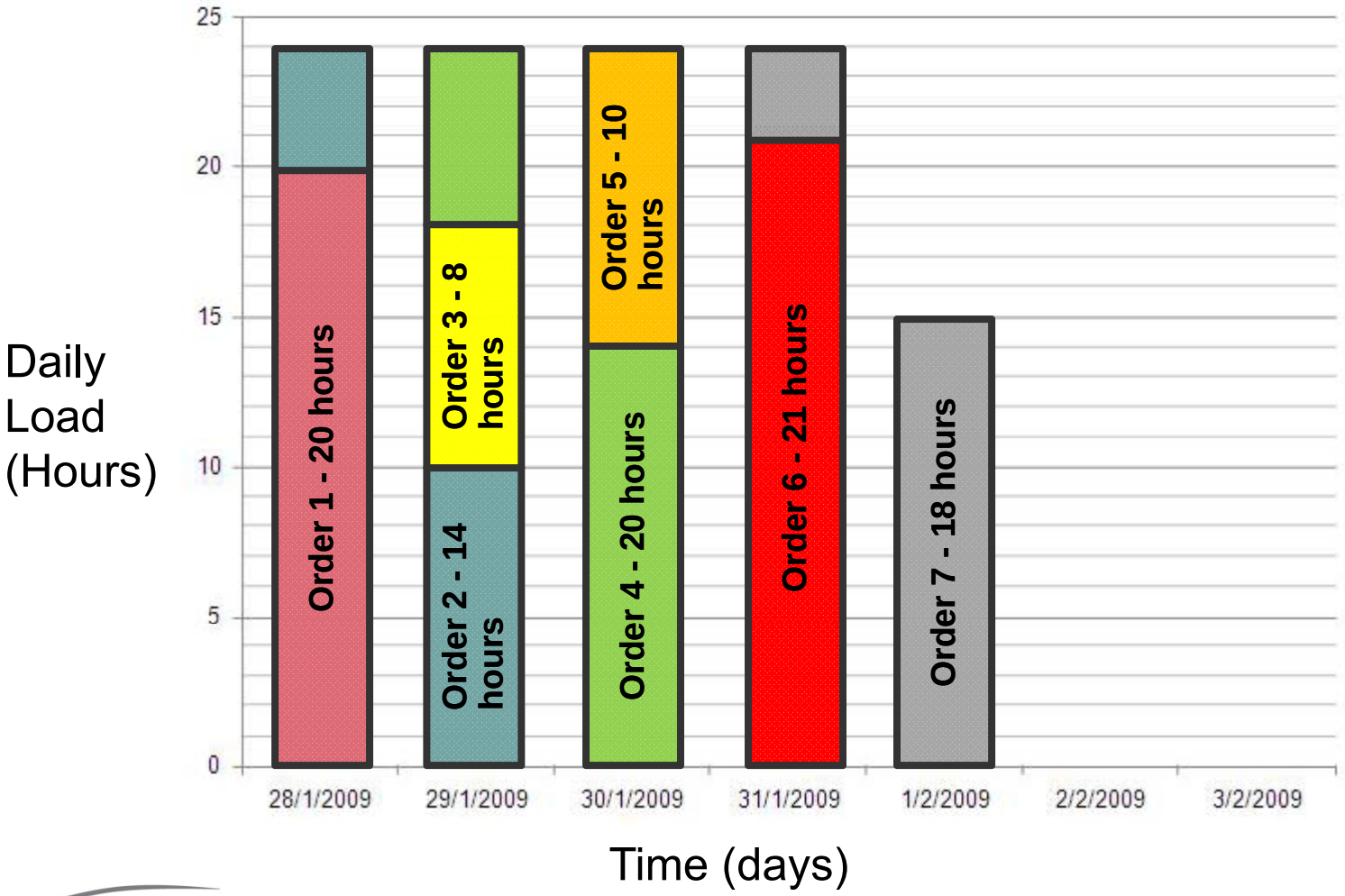
The Planned Load - The tool for checking the capacity

- **The following concept of DBR is still a cornerstone in the proposed S-DBR solution:**
  - **Complex as the operational system may be, the output is dominated by one resource with the least capacity.**
- **Based on that concept, the capacity monitoring, replacing the detailed schedule, is based on the following concept:**

Definition – Planned Load:

The Planned load is the accumulation of the derived load on the CCR of all the firm orders that have to be delivered within a certain horizon of time.

A visual representation of the planned load



The critical information obtained from the planned-load

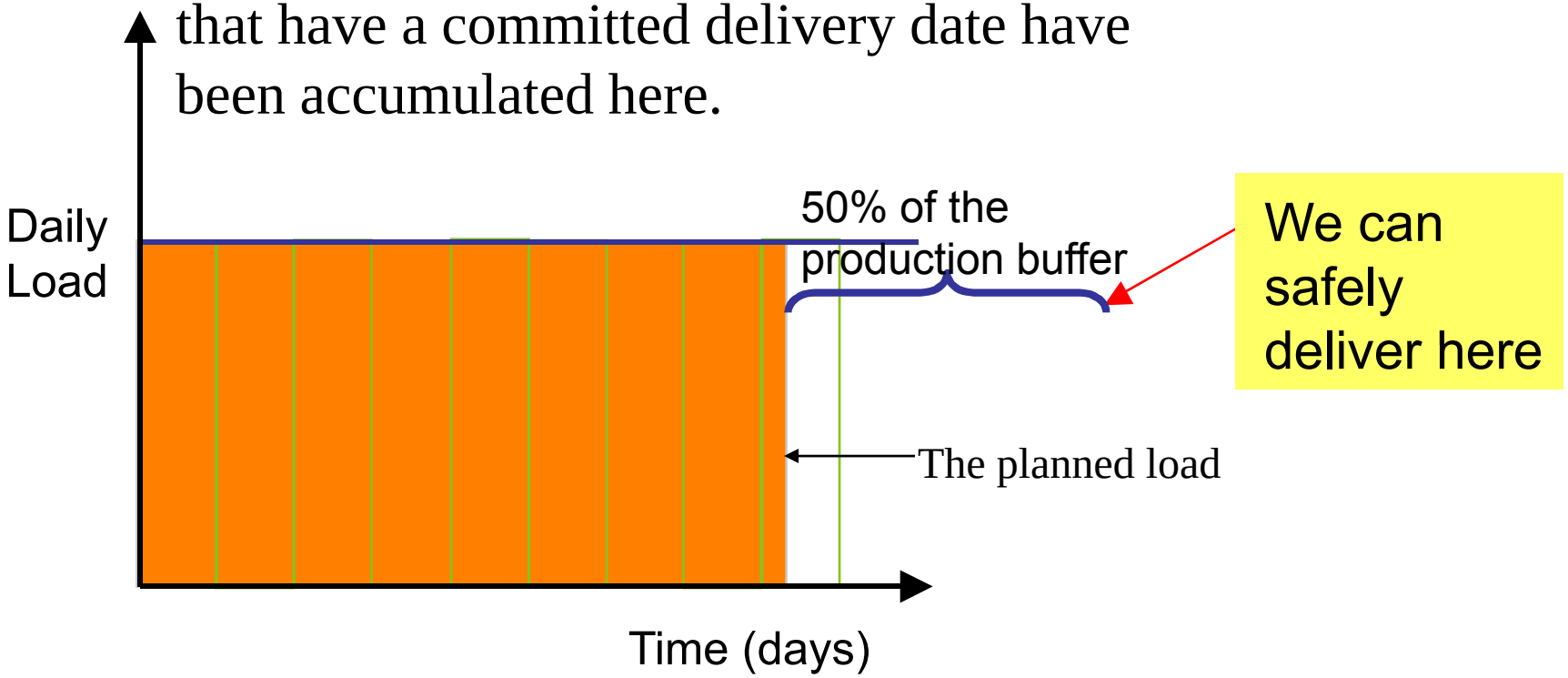
- **The most important feature of the planned load is:**

A rough estimation of the time for a new order to wait until being processed by the CCR

- **This time estimation allows us to determine a "safe-date" for which we can commit to complete the new order.**
  - **We need to add certain time to the planned-load to provide the order with enough time to be processed by the CCR and the downstream operations.**
    - **Considering also possible delays and flexibility given to the CCR in deciding when to process that order.**
  - **The default in S-DBR is to add ½ of the production buffer time to the planned load to determine the safe date.**

Using the planned-load to estimate safe delivery dates for new incoming orders

All the required CCR load for the orders that have a committed delivery date have been accumulated here.



The subtle difference between the planned - load and the detailed schedule of the CCR

- **The planned-load looks like a schedule because it places the required CCR's operations on the time frame.**
  - **But, it does not impose the sequence on the operators.**
  - **Many times the time allotted to an order on the planned-load is not realistic.**
    - **For instance, when several different operations require the CCR for the same order.**
- **All we need the planned-load for is to estimate the earliest due-date for a new order that is pretty certain.**
  - **And for that the rough estimation is enough.**
  - **Having capacity requirements and response time together creates an effective tool for monitoring capacity.**
  - **The overall buffer time provides enough flexibility to maneuver the actual sequence on the CCR.**

Sales and Production planning in S-DBR

- **The planned-load is used to support decisions on committing to reliable due-dates.**
  - **Not necessarily Sales should always offer the safe-date.**
  - **At peak-times the safe-dates get longer due to the longer queue of work already committed to be delivered.**
  - **At off-peak times the safe-dates are relatively early.**
- **The visibility of the "safe-dates" should be easily accessed by the sales people as the critical information required from Production.**

GOLDRATT schools

The advantages of S-DBR over DBR

- **The managerial focus is put mainly on the market demand.**
- **Sales are properly supported online by giving a direct access to “safe-dates” for any new order.**
- **Buffer management in S-DBR is much more effective in handling the priorities than the three separate buffers in DBR.**
- **S-DBR can be implemented faster – bring results sooner.**

GOLDRATT schools

The advantages of S-DBR over DBR

- **S-DBR requires much simpler algorithm from the supporting software than DBR.**
  - **To illustrate the complexities DBR sometimes faces:**
    - **Scheduling several CCR operations for one order.**
    - **Scheduling several non-identical units of the CCR.**
    - **Scheduling resources like ovens, which take several orders and work on the whole batch rather than one piece at the time.**
  - **All the above do not complicate the S-DBR algorithm and it remains effective.**
- **When the constraint moves to another resource, S-DBR needs only to change the ID for the planned-load.**

When S-DBR cannot apply

- **The idea of refraining from detailed schedule of the CCR and yet being able to control the CCR's capacity is based on the assumption:**

  The sequence of production does not significantly impact the capacity.

- **The one situation where the above assumption is not valid is called: sequence-dependent setups.**
  - **The setup time heavily depends on both the previous setup and the next one.**
  - **This situation calls for having to follow a "preferred sequence", which means very limited ability to expedite.**
  - **Handling this situation is beyond the scope of the webinar.**

Implementing S-DBR

- **Important insight regarding implementation of a paradigm change is:**

  It is imperative to get results very soon!

  - **This means we must plan the implementation so the first steps will already generate significant results.**
  - **There is definitely no need to identify the weakest link / CCR at the start of the implementation.**
- **The first and most important action has to be: choking the release.**
  - **Limiting the WIP to contain only what has to be delivered within the production time buffer.**
- **The default for the initial production buffer is: 50% of the current production lead-time.**

DBR from a different perspective: guidelines for ANY planning

- **Drum: Identify and carefully plan the critical areas where any deviation would clearly cause damage (to the objectives of the planning).**
- **Buffer: Protecting the drum instructions mainly from disruptions at the non-critical areas.**
- **Rope: Protects the buffers from over-protection.**
  - **Usually is means choking the release of work/missions to ensure adequate protective capacity.**
- **Note, protective capacity is part of the overall buffering system.**
- **The above is true for S-DBR, CCPM and for any type of planning.**

GOLDRATT schools

TOC ICO

The road to simple and effective solutions

- **The concepts for managing manufacturing organizations were not invented in very short time.**
- **Coming out of complexity to recognize the simple rules behind it is not easy.**
- **Once we recognize the distinction between planning and execution we move to a simpler, yet effective, scheme.**
- **And the basics of TOC still hold!**

GOLDRATT schools

Questions?

Eli Schragenheim's new book, together with Bill Dettmer and Wayne Patterson:

Supply Chain Management at Warp Speed

Will be out in May 2009

Covering the new knowledge in Make-to-order, Make-to-Availability and Distribution.

Eli Schragenheim
elyakim@netvision.net.il