

PESW 2014, 12. 06. 2014

Time Patterns Relation in Assisted Automated Scheduling

Program

1. Introduction
2. Timetable
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6. Further research

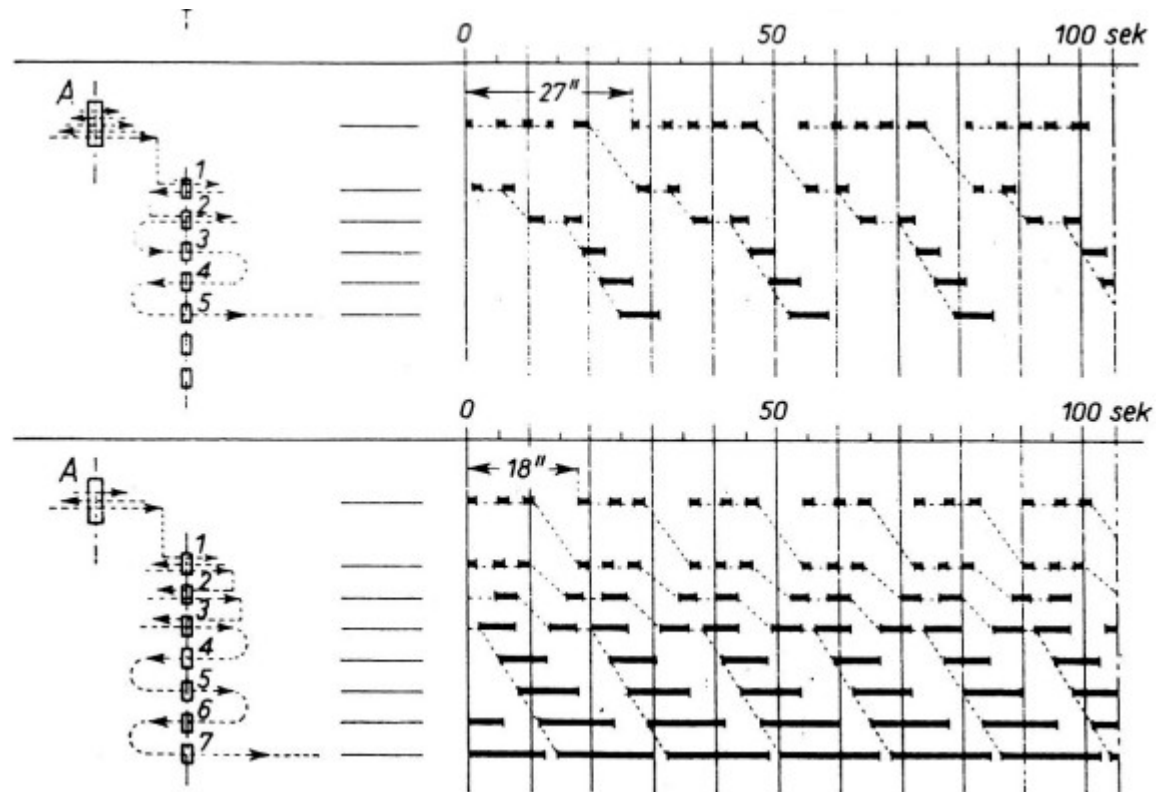


1. Introduction (1)

First timetables:

1903 – Karol Adamecki

Graphical method of
analysis and planning



1. Introduction (2)

First timetables:

1917 – L. H. Gantt

Graphical method of
planning and control

MILL, *Textile* ----- June,

| SYMBOL | DEPARTMENT OR MACH. CLASS | % OF CAPACITY USED ON <i>Day</i> TURN | TOTAL EXPENSE OF IDLENESS | DETAILS OF IDLENESS EXPENSE DUE TO | | | | |
|--------|---------------------------|---------------------------------------|---------------------------|------------------------------------|--------------|---------------------------|---------|---------------|
| | | | | LACK OF WORK | LACK OF HELP | LACK OF AND POOR MATERIAL | REPAIRS | POOR PLANNING |
| | <i>Spinning</i> | | 18 70 | 18 70 | | | | |
| | <i>Winding</i> | | 118 74 | | 103 74 | | 15 00 | |
| | <i>Doubling</i> | | 10 61 | 10 61 | | | | |
| | <i>Twisting</i> | | 17 95 | 17 95 | | | | |
| | <i>Quilling</i> | | 70 67 | 10 67 | 10 00 | | | |
| | <i>Warping</i> | | 390 75 | | | 390 75 | | Lack o |
| | <i>Weaving</i> | | 915 25 | 75 00 | | 840 25 | | Lack o |
| | <i>Finishing</i> | | 210 72 | | | 210 72 | | Lack o |
| | <i>Inspecting</i> | | 49 70 | | 10 70 | 39 00 | | Lack o |
| | <i>Shipping</i> | | 216 17 | 66 00 | | 150 17 | | Lack c |
| | <i>Total</i> | | 1969 26 | 198 93 | 124 44 | 1630 89 | 15 00 | |

APPROVED

1. Introduction (3)

Examples of timetables:

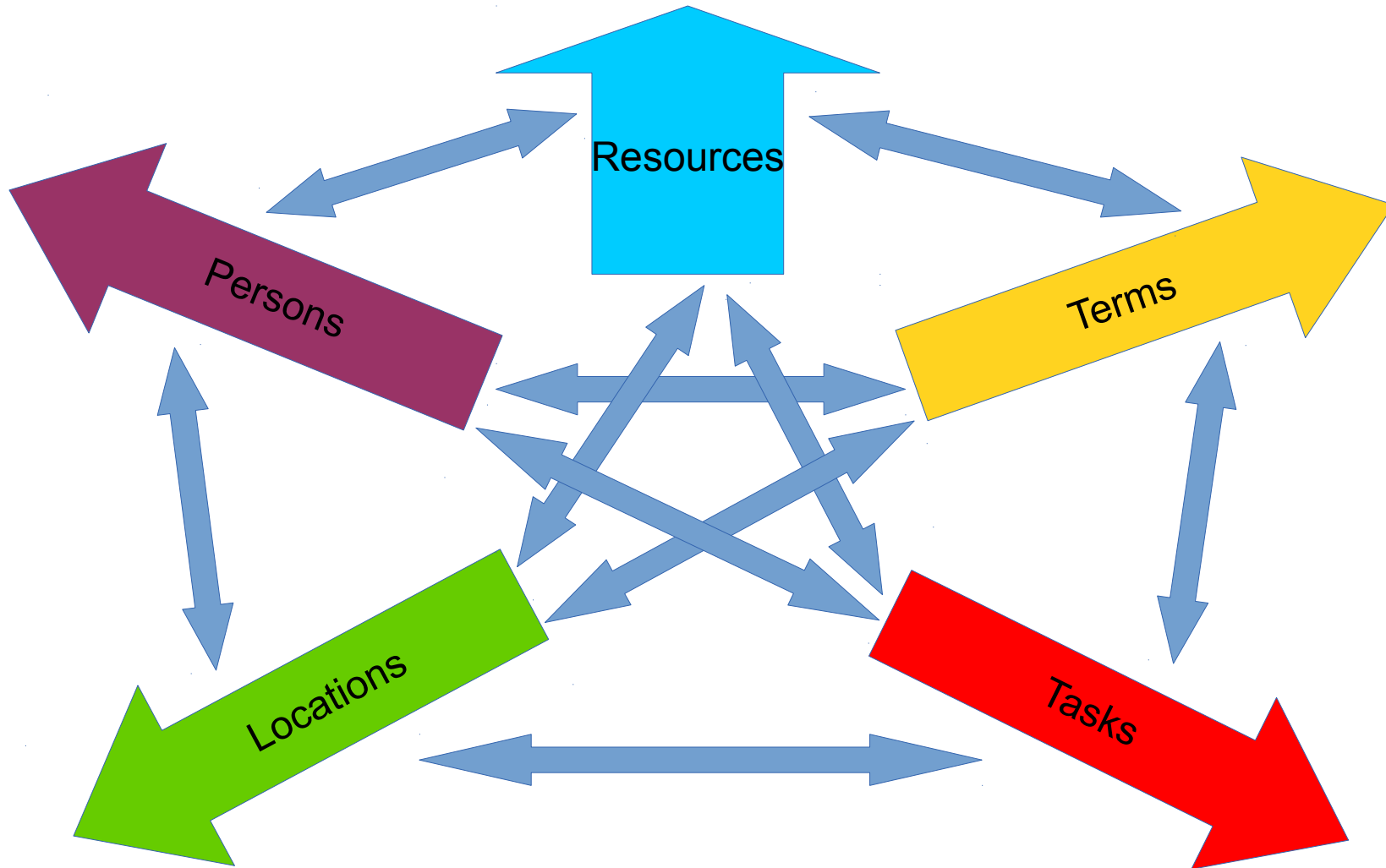
- School timetable
- Delivery schedule
- Railway guide
- Project schedule
- Production schedule

— Harmonogram wyłączeń stacji analogowych w okresie przejściowym

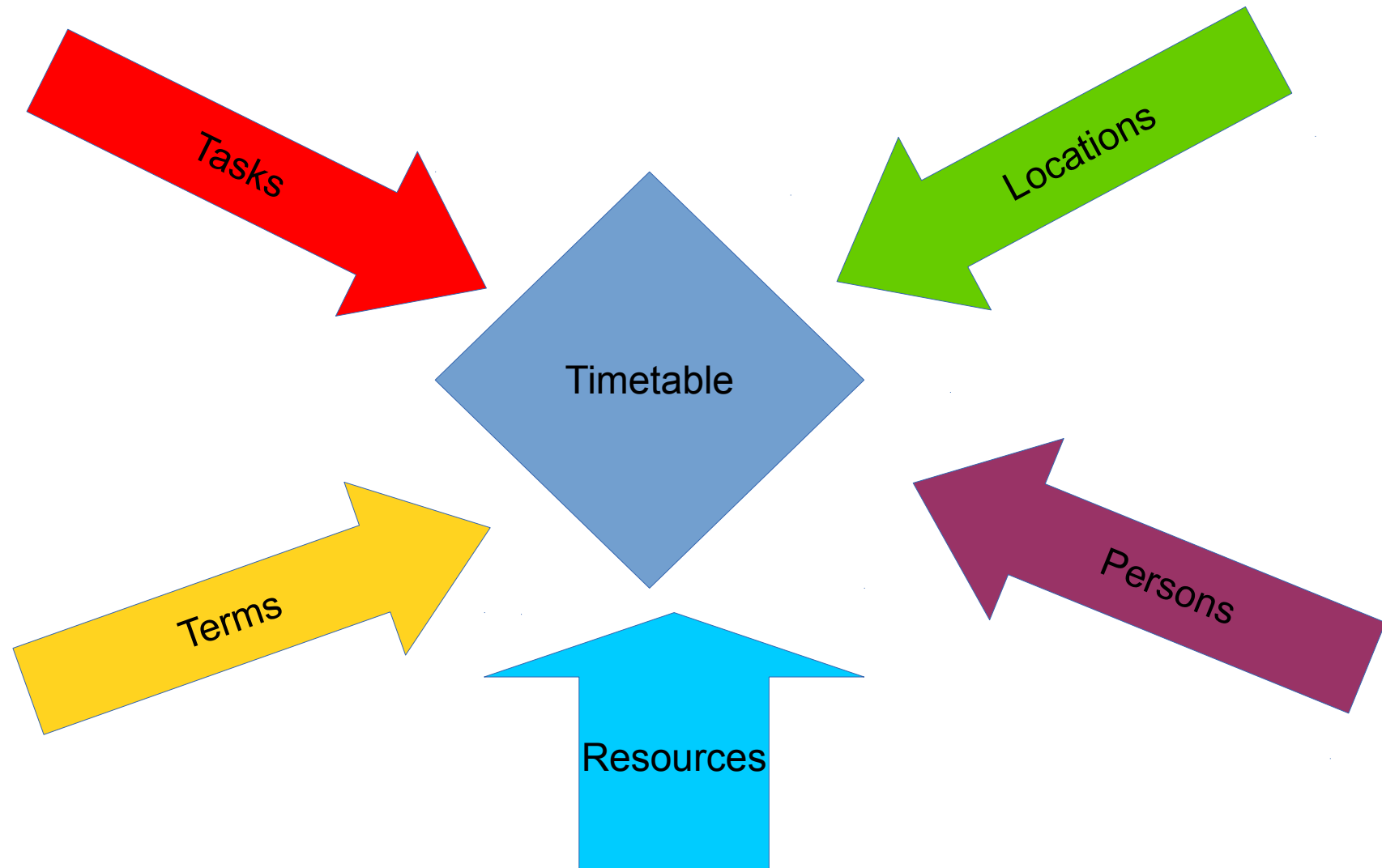
| Etapy i Regiony | Termin odw/STB wtys. | 1Q09 | 2Q09 | 3Q09 | 4Q09 | 1Q10 | 2Q10 | 3Q10 | 4Q10 | 1Q11 | 2Q11 | 3Q11 | 4Q11 | 1Q12 | 2Q12 | 3Q12 | 4Q12 | | |
|-----------------|--|---------------------------|----------------------|-------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|---|
| | | 1 | Lubuskie Warszawa | 140 350 490 | | | | | | | | | | | | | | | |
| 2 | Śląskie Opolskie Łódzkie razem | 680 130 380 1190 | | | | | | | | | | | | | | | | | Mux 3 Mux 1 i 2 |
| 3 | Małopolskie Podkarpackie Dolnośląskie razem | 420 250 410 1080 | | | | | | | | | | | | | | | | | Mux 3 Mux 1 i 2 |
| 4 | Wielkopolskie Zachodniopomorskie Pomorskie razem | 420 230 300 950 | | | | | | | | | | | | | | | | | Mux 3 Mux 1 i 2 |
| 5 | Kujawsko-pomorskie Warmińsko-mazurskie Podlaskie razem | 270 190 160 620 | | | | | | | | | | | | | | | | | Mux 3 Mux 1 i 2 |
| 6 | Mazowieckie bez Warszawy Lubelskie Świętokrzyskie razem | 320 280 170 770 | | | | | | | | | | | | | | | | | Mux 3 zakończenie okresu przejściowego |

— emisja równoległa wszystkich kanałów analogowych Mux1
 — emisja równoległa kanałów n - 1
 — wyłączenie stacji analogowych

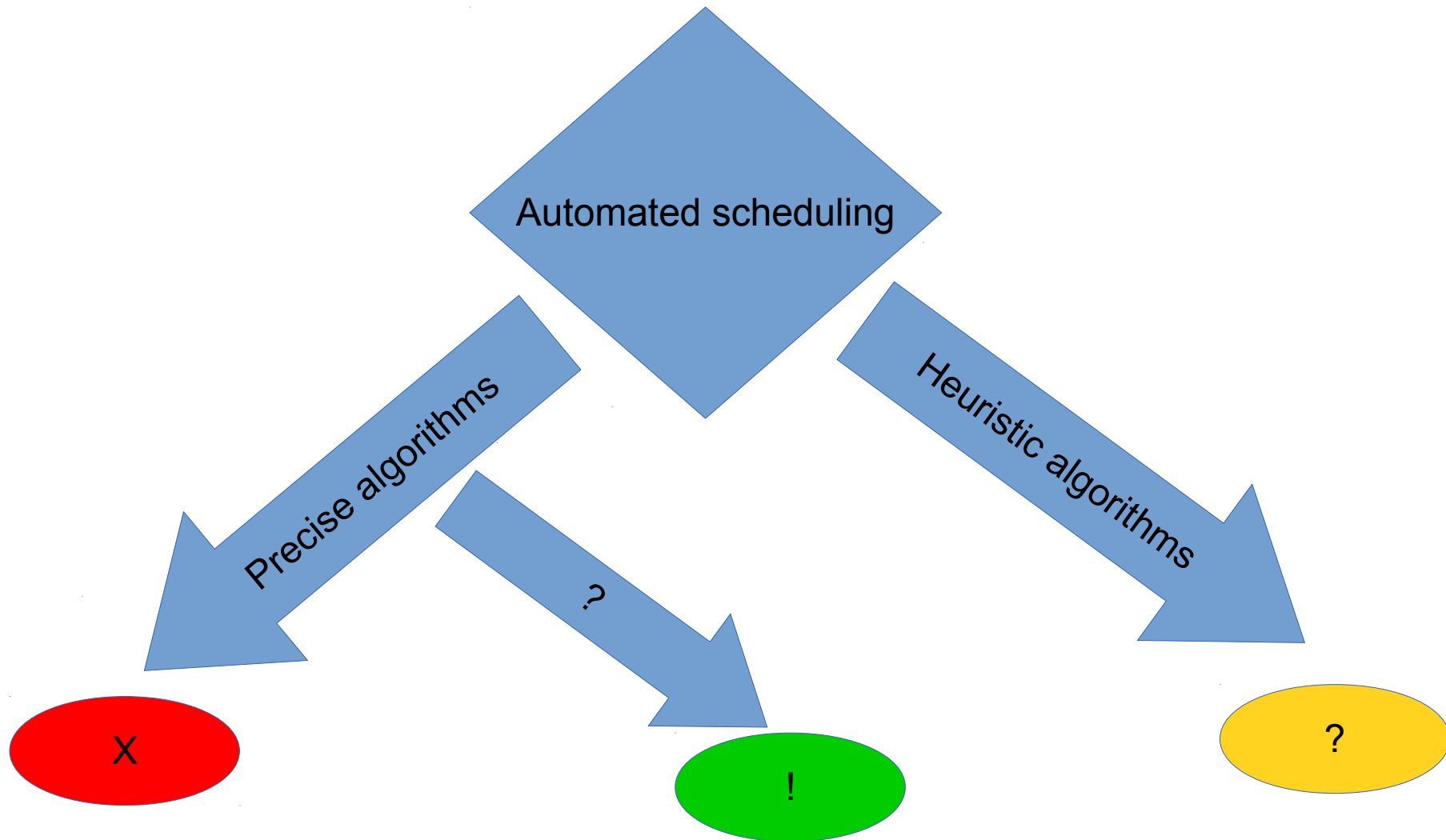
2. Timetable (1)



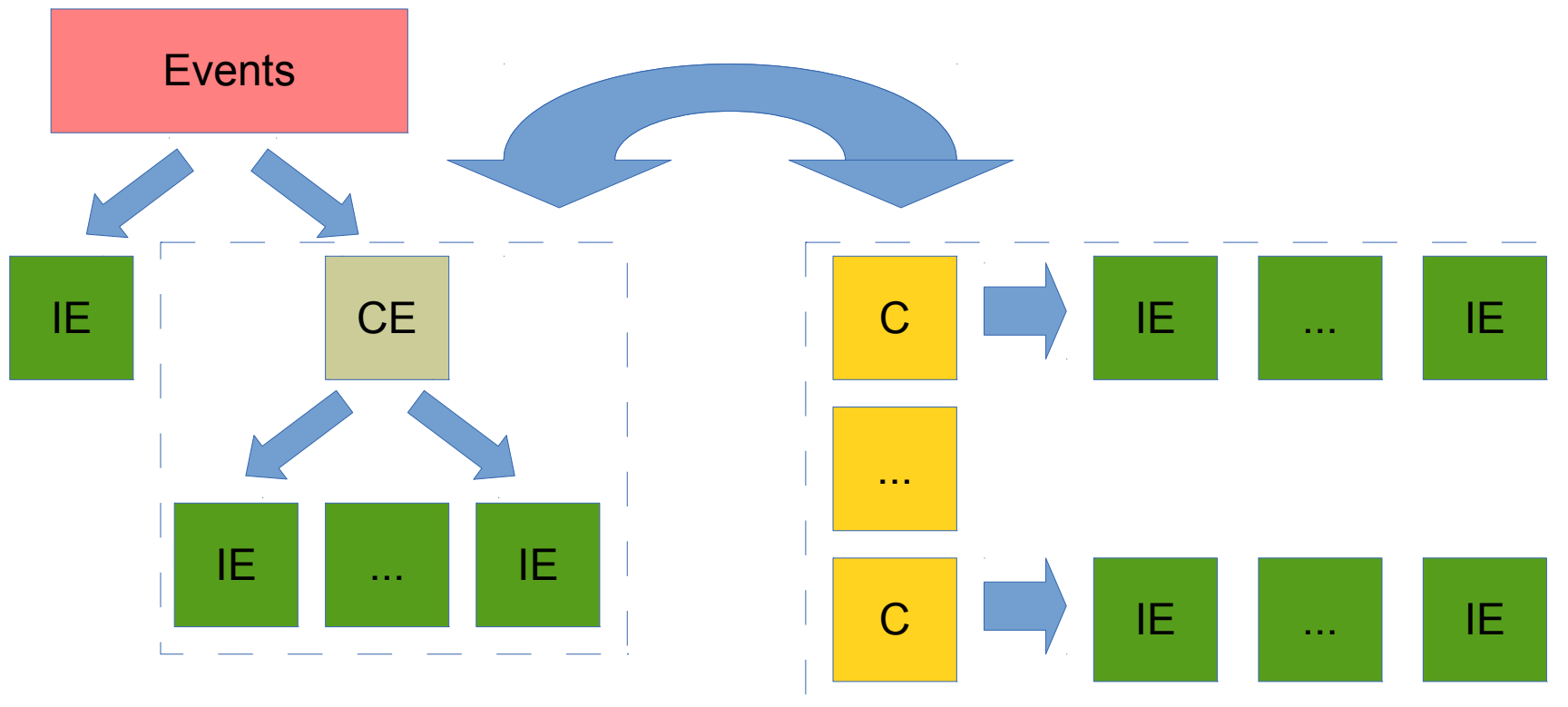
2. Timetable (2)



2. Timetable (3)



3. Time patterns (1)



3. Time patterns (2)

Sum of all events in modeled system with cyclic events:

$$SE = \sum_i^I \sum_j^{J_i} \sum_k^{K_j} (IE_{x,k} + EI_{x,k})$$

where:

SE – sum of all events in modeled system,

I – number of different Individual Events IE ,

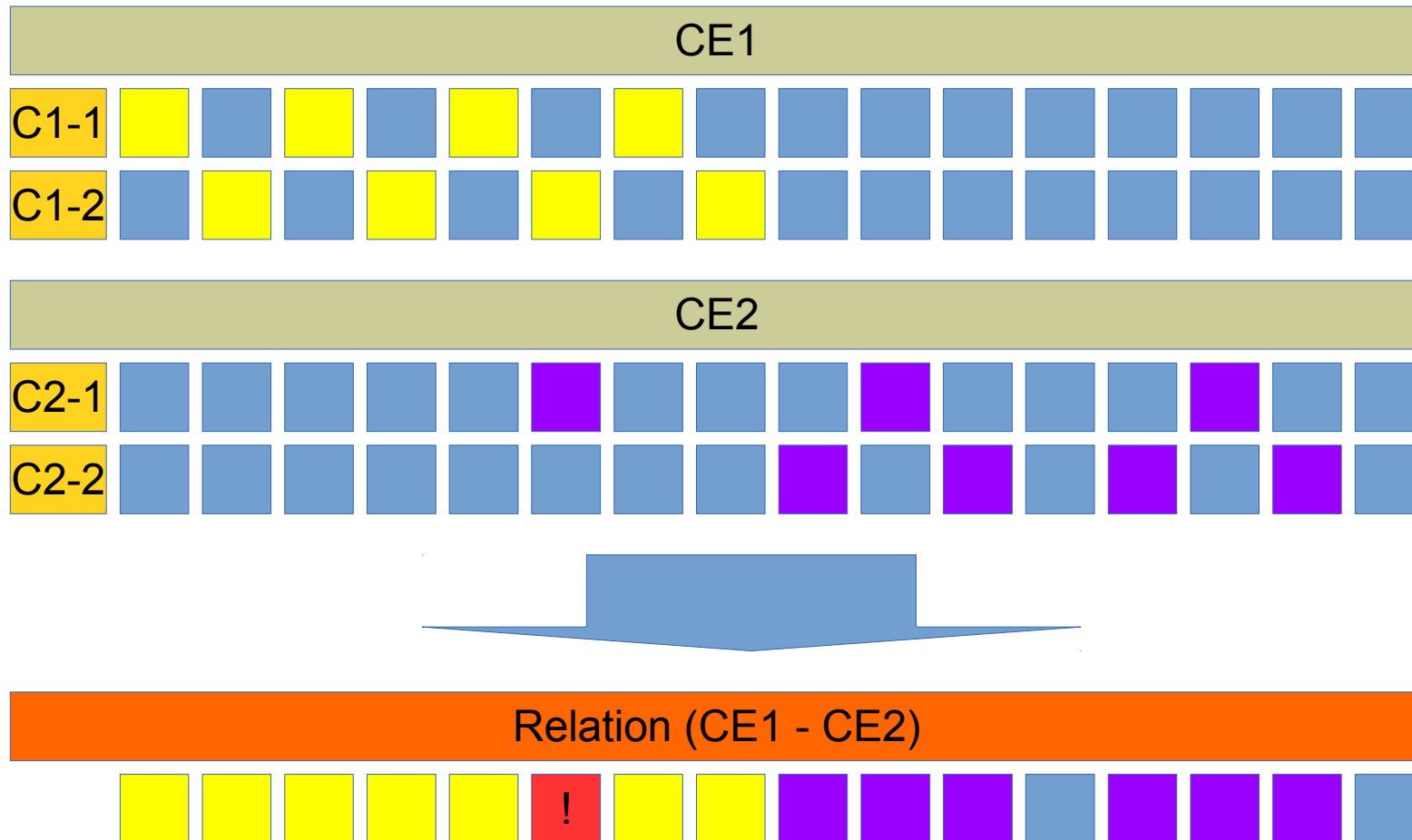
J_i – number of cycles in a cyclic event i ,

K_j – number of Individual Events IE in a cycle j ,

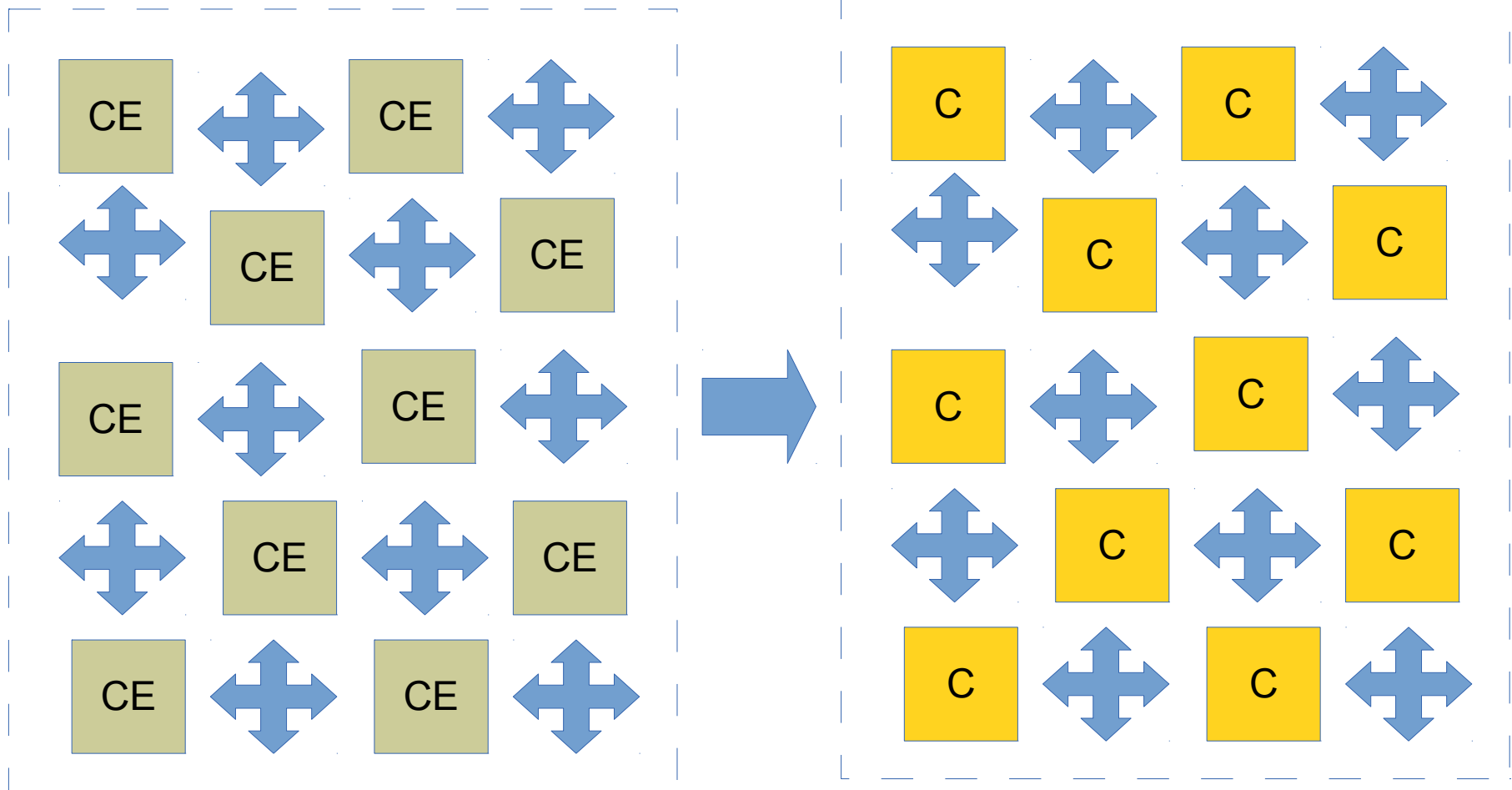
$IE_{x,k}$ – Individual Event of type x in a cycle j ,

$EI_{x,k}$ – Event Interval for Individual Event of type x in a cycle j .

4. Patterns relation (1)



4. Patterns relation (2)



5. Summary (1)

- Real life timetable depends on cyclic events
- Cyclic events are based on time patterns
- Time patterns relations determine the correctness of the timetable



5. Summary (2)

- Computational cost of timetable creation depends on complexity of system model
- Current methods supports only simplified models
- Full time patterns processing based on current models is unprofitable



6. Further research

- Usage of existing methods of time patterns description for creation of efficient time dimension of system model



- Transformation of formal described models into flexible structure adaptable for the variety of heuristic algorithms



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Thank you for your attention