Institut Mines-Télécom

CHAINE NUMÉRIQUE ET INTELLIGENCE DE PROCESSUS

Prof. IMED BOUGHZALA

INSTITUT MINES-TELECOM BUSINESS SCHOOL

Prof. WALID GAALOUL

TELECOM SUDPARIS

IMT Atlantique Bretagne-Pays de la Loire École Mines-Télécom

IMT Lille Douai École Mines-Télécom IMT-Université de Lille

IMT Mines Albi-Carmaux École Mines-Télécom

IMT Mines Alès École Mines-Télécom

MINES Saint-Étienne Une école de l'IMT

Institut Mines-Télécom Business School

TELECOM ParisTech Une école de l'IMT

TELECOM SudParis Une école de l'IMT

EURECOM

InSIC

MINES ParisTech

MINESnancy

ensiie Paris-Évry I Strasbourg

ARMINES

La recherche CARNOT pour les entreprises

OUTLINE

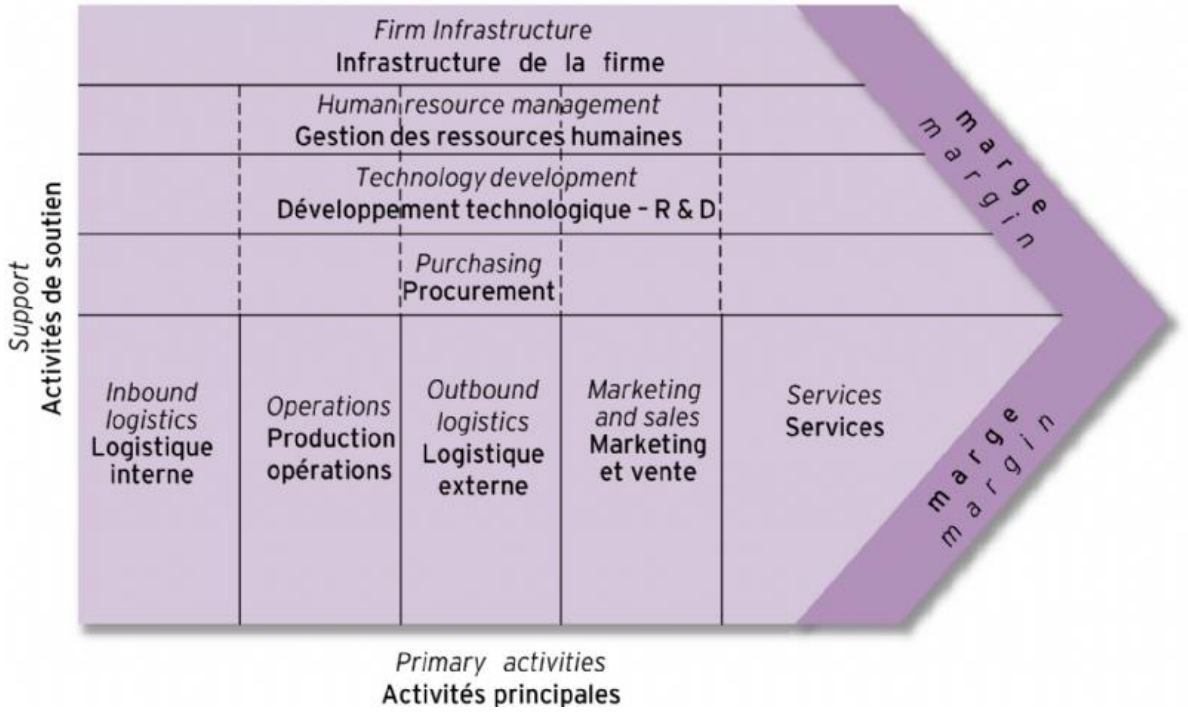
1.DATA BASED DIGITAL CHAIN

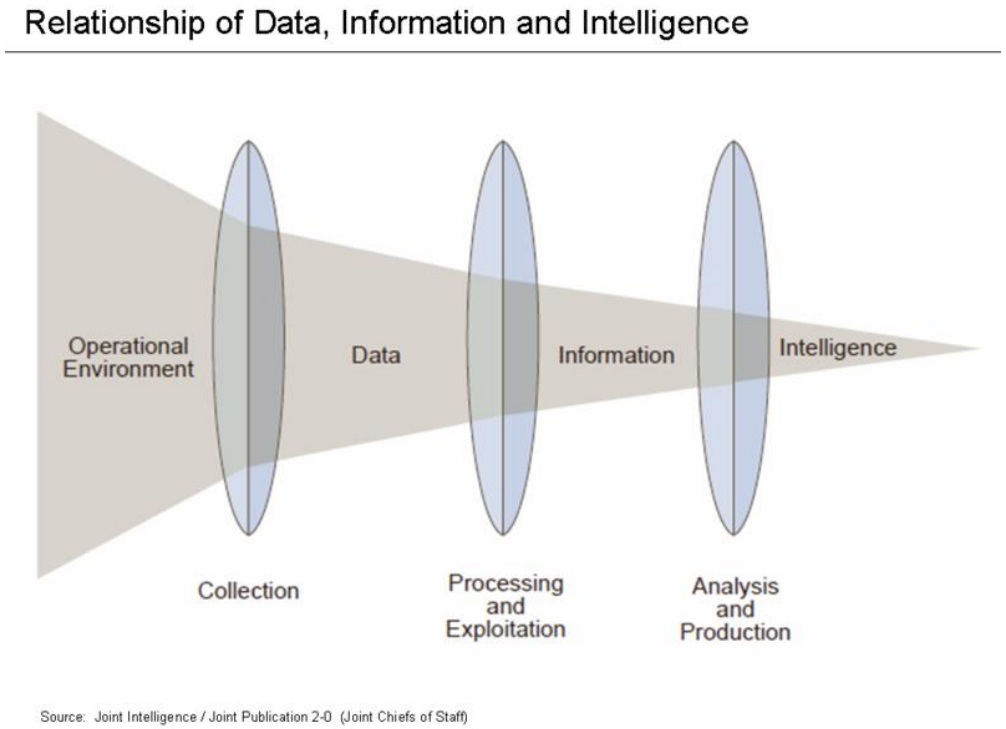
2.PROCESS INTELLIGENCE

Institut Mines-Télécom

DATA BASED DIGITAL CHAIN

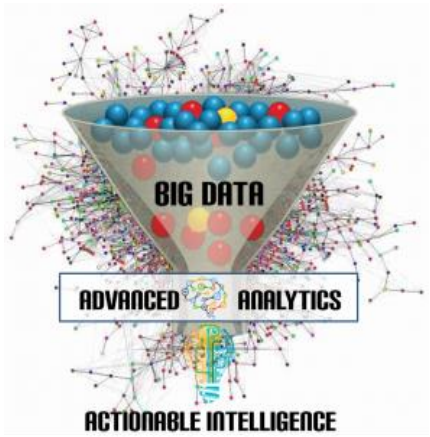
Institut Mines-Télécom


Firm Infrastructure
Infrastructure de la firme
Human resource management
Gestion des ressources humaines
Technology development
Développement technologique - R & D
Purchasing
Procurement
Support
Activités de soutien
Inbound logistics
Logistique interne
Operations
Production opérations
Outbound logistics
Logistique externe
Marketing and sales
Marketing et vente
Services
Services
marge
margin
marge
margin
Primary activities
Activités principales


Relationship of Data, Information and Intelligence
Operational Environment
Data
Information
Intelligence
Collection
Processing and Exploitation
Analysis and Production
Source: Joint Intelligence / Joint Publication 2-0 (Joint Chiefs of Staff)

Data Sources

- SMAC

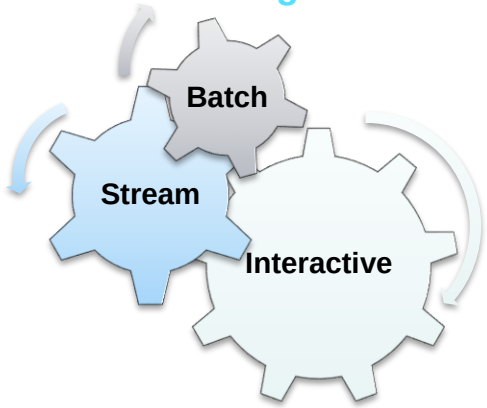


Big Data is “a holistic approach which refers to the practice of collection and processing of very large and complex data and associated advanced techniques and technologies used to analyze in real-time or batch these data, in order to create value.”

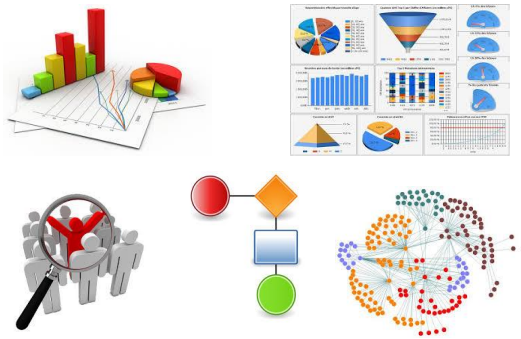
Process

- Generation
- Acquisition
- Storage
- Analysis
- Visualization

Technologies



BD analytics Techniques

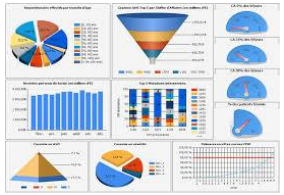


Compliance

- RGPD

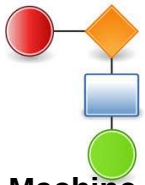
- Improving decision making
- Improving operational excellence
- Offer customizing
- Proposing new value added products and services

Statistics

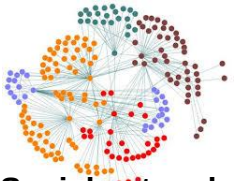


Data visualization

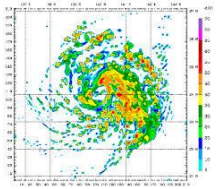
Data mining



Machine Learning



Social network analysis



Optimization methods

Descriptive analytics

Predictive analytics

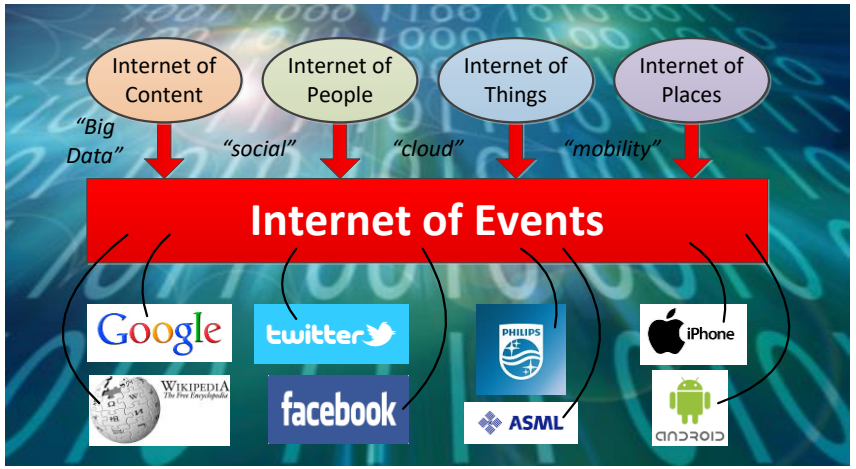
Prescriptive analytics

PROCESS INTELLIGENCE

Institut Mines-Télécom

Why do customers have to wait so long ?
Why much staff is needed tomorrow?
Why do logistic worker follow the guidelines?
Can we predict waiting times?
Can we reduce costs?

"ALWAYS ON": ANYTHING, ANYTIME, ANYWHERE



order number	activity	timestamp	user	product	quantity
9901	register order	22-1-2014@09.15	Sara Jones	iPhone5S	1
9902	register order	22-1-2014@09.18	Sara Jones	iPhone5S	2
9903	register order	22-1-2014@09.27	Sara Jones	iPhone4S	1
9901	check stock	22-1-2014@09.49	Pete Scott	iPhone5S	1
9901	ship order	22-1-2014@10.11	Sue Fox	iPhone5S	1
9903	check stock	22-1-2014@10.34	Pete Scott	iPhone4S	1
9901	handle payment	22-1-2014@10.41	Carol Hope	iPhone5S	1
9902	check stock	22-1-2014@10.57	Pete Scott	iPhone5S	2
9902	cancel order	22-1-2014@11.08	Carol Hope	iPhone5S	2
...	...	...	...	...	...

case id | activity name | timestamp | resource | other data

©Wil van der Aalst & TU/e (use only with permission & acknowledgements)

TU/e

- What is the process that people really follow?
- Where are the bottlenecks in my process?
- Where do people (or machines) deviate from the expected or idealized process?
- What are the "highways" in my process?
- What factors are influencing a bottleneck?
- Can we predict problems (delay, deviation, risk, etc.) for running cases?
- Can we recommend counter measures?
- How to redesign the process / organization / machine?

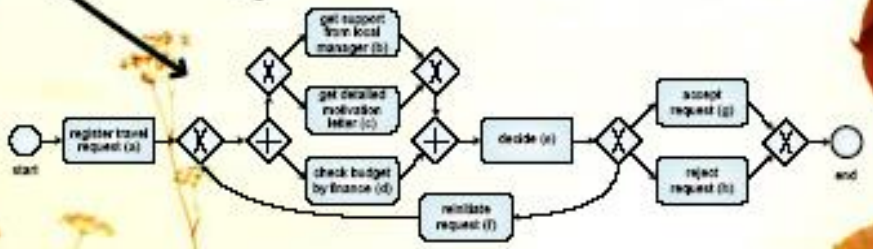
Let's play

Case	Activity	Timestamp	Resource
432	register travel request (a)	15-3-2014:8.15	John
432	get support from local manager (b)	16-3-2014:8.25	Mary
432	check budget by finance (d)	16-3-2014:8.66	John
432	decide (e)	16-3-2014:8.36	Sue
432	accept request (g)	16-3-2014:8.48	Mary

Play-In

Replay

Play-Out



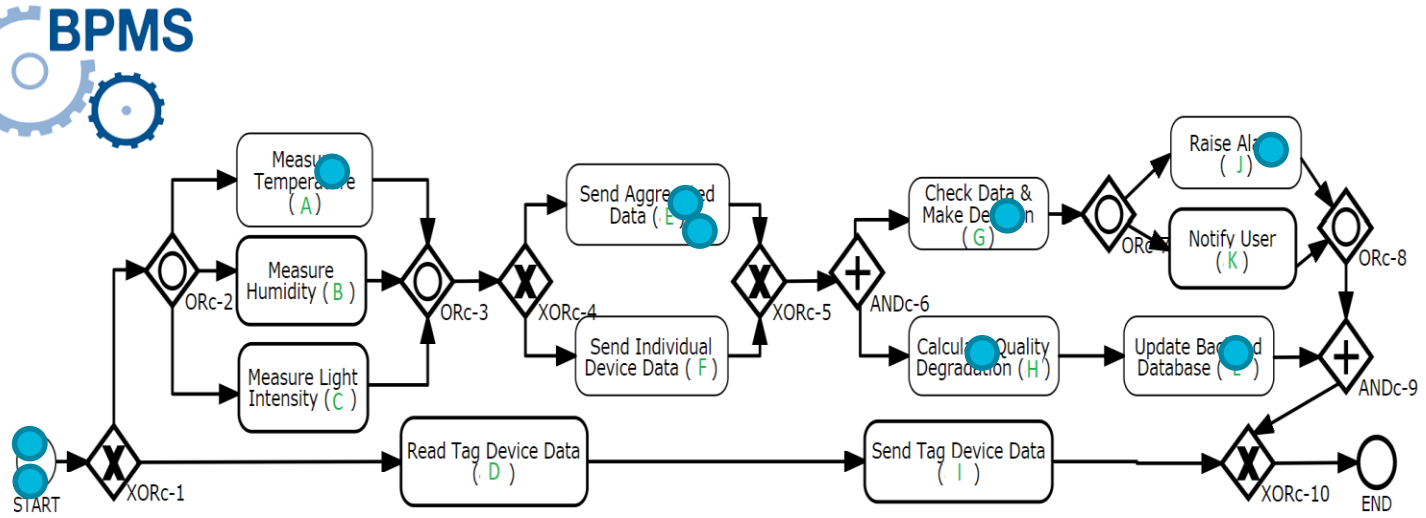
©Wil van der Aalst & TU/e (use only with permission & acknowledgements)

Play-Out

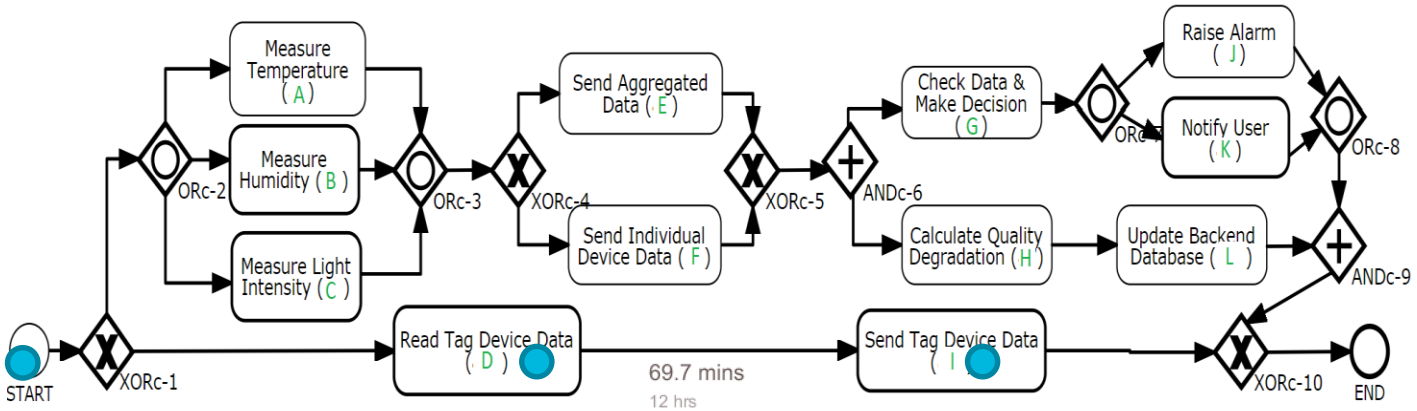
Case	Activity	Timestamp	Resource
432	register travel request (a)	19-3-2014:9.15	John
432	get support from local manager (b)	18-3-2014:9.25	Mary
432	check budget by finance (d)	19-3-2014:8.55	John
432	decide (e)	19-3-2014:9.36	Sue
432	accept request (g)	19-3-2014:9.48	Mary

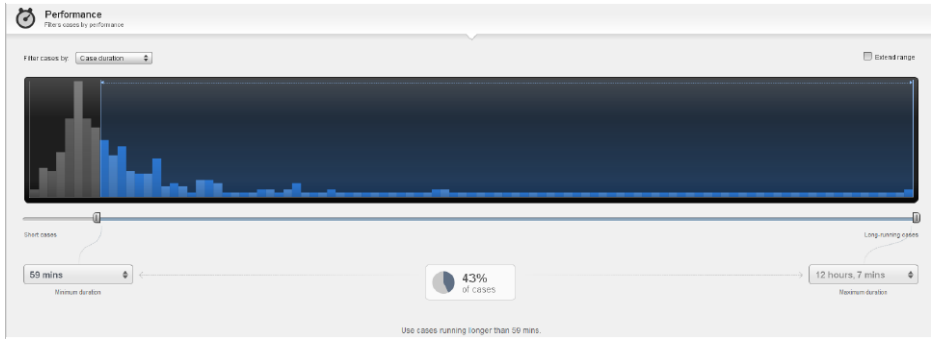
©Wil van der Aalst & TU/e (use only with permission & acknowledgements)

PLAY OUT: DESCRIPTIVE ANALYTICS

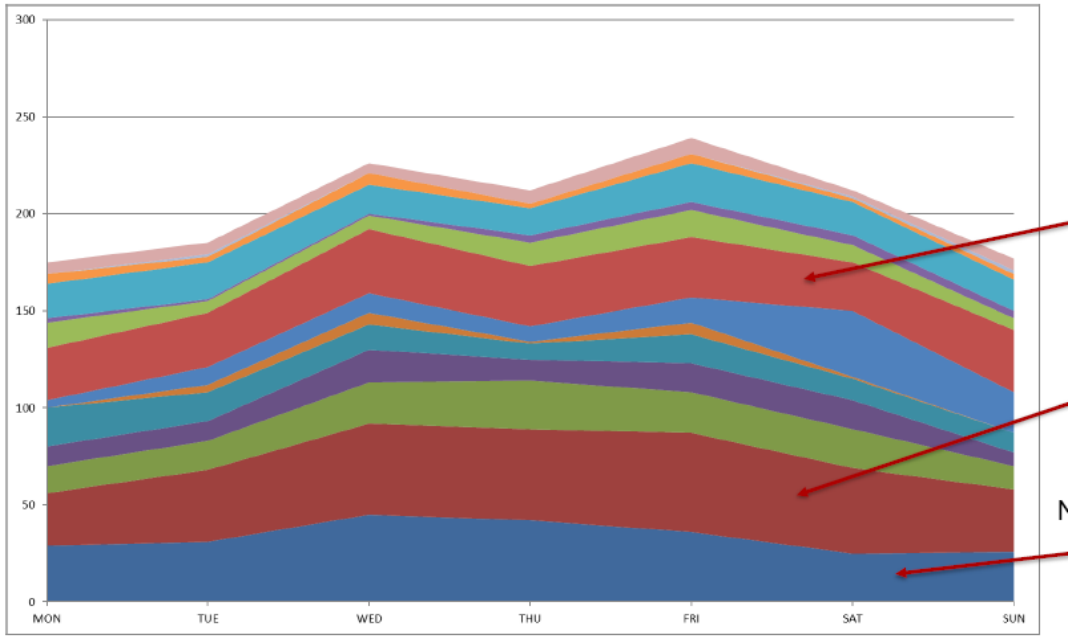


A B E G H K L





A B E G H D L
D I
B F H G I K L
C E H G L K
A F H L G L J
D I
A B E H G L I



Vegetables & fruit

Humidity sensible

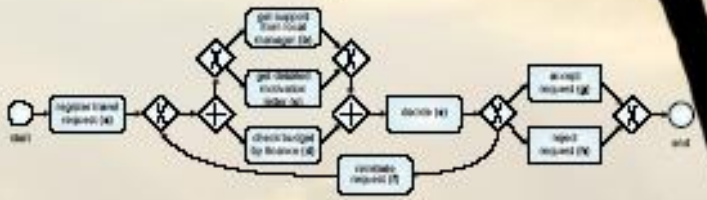
Dairy food

Process oriented key performance computation

- Instance : distribution based on goods type
- Time :Week distribution, duration
- Organization: Agent performance

Play-In

Case	Activity	Timestamp	Resource
452	register travel request (a)	10-3-2014:9.10	John
452	get support from local manager (b)	10-3-2014:9.25	Mary
452	check budget by finance (d)	10-3-2014:9.55	John
452	decide (e)	10-3-2014:9.36	Sue
452	accept request (g)	10-3-2014:9.48	Mary



©Wil van der Aalst & TU/e (use only with permission & acknowledgements)

A B D E F

A B D E C F

A B D E F C

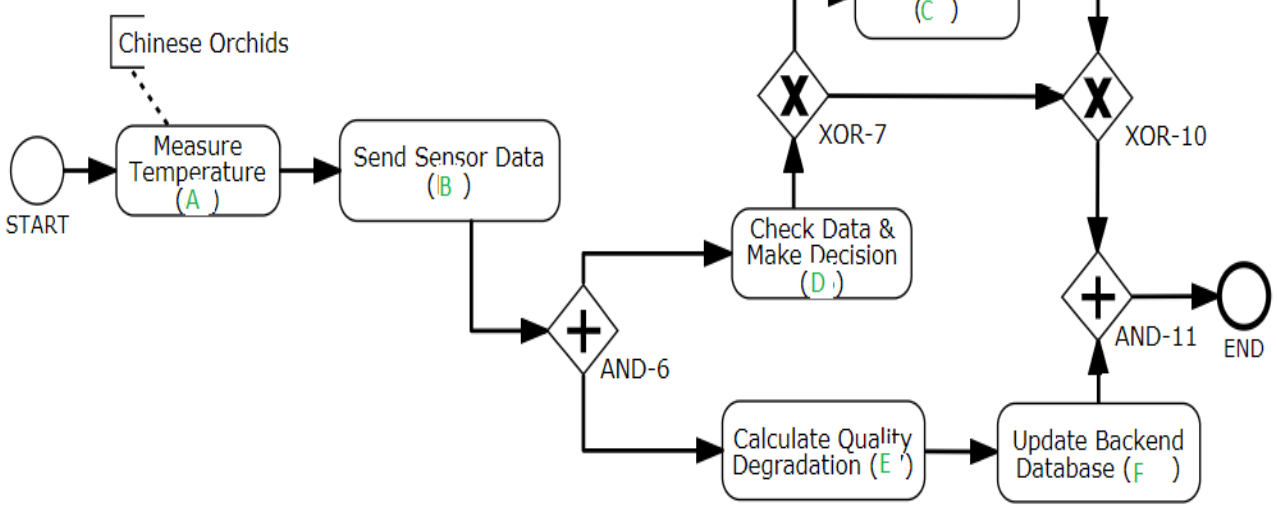
A B D E F C

A B E F D C

A B E D F C

A B E F D C

A B D E F



Process Discovery

- No process model needed as input
- Formal presentation
- Process visualization
- Flow prediction : Activity precedence, conditions, concurrence

PROCESS DISCOVERY IS LIKE LEARNING A LANGUAGE: BY EXAMPLE

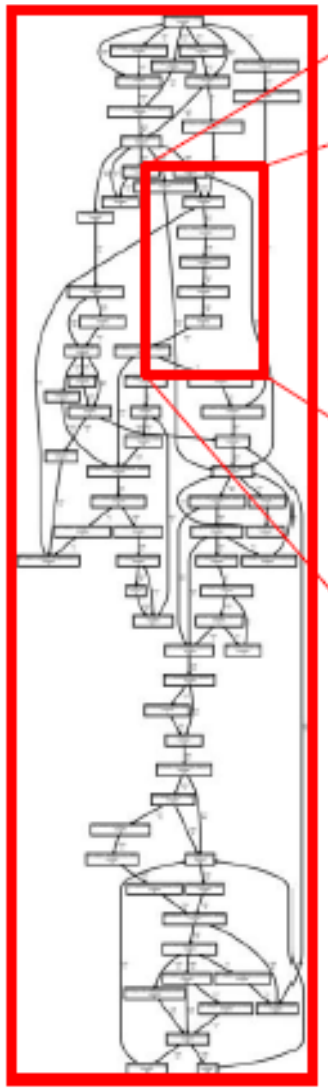
sentence ≅ trace in event log ...

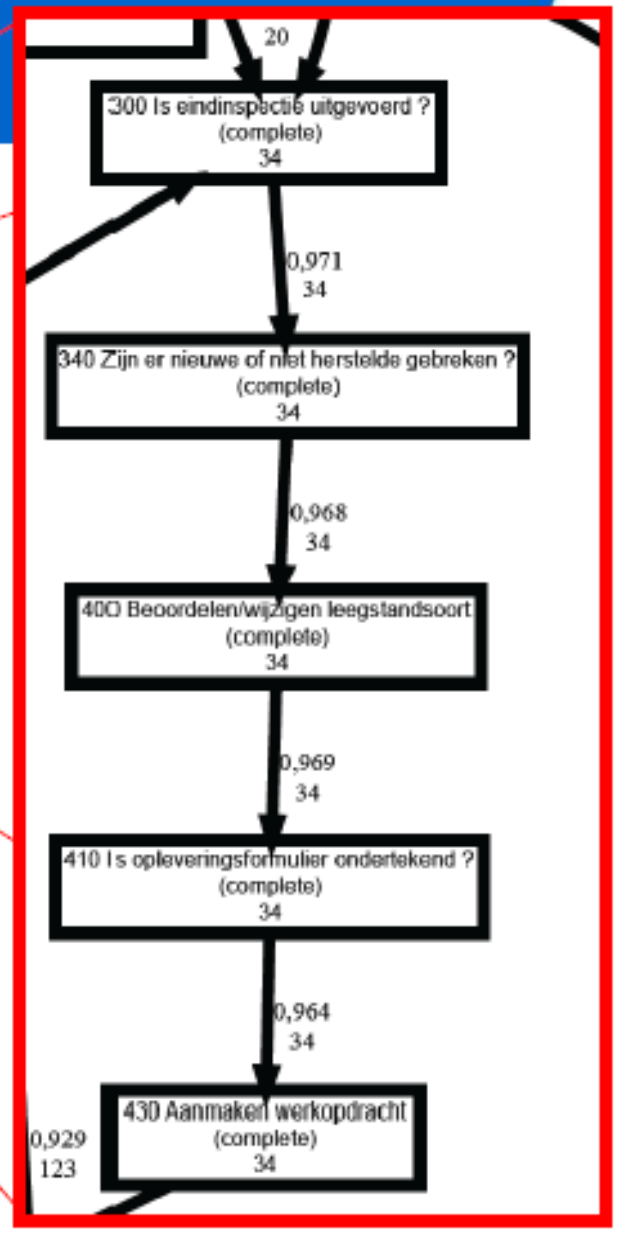
language ≅ process model

©Wil van der Aalst & TU/e (use only with permission & acknowledgements)

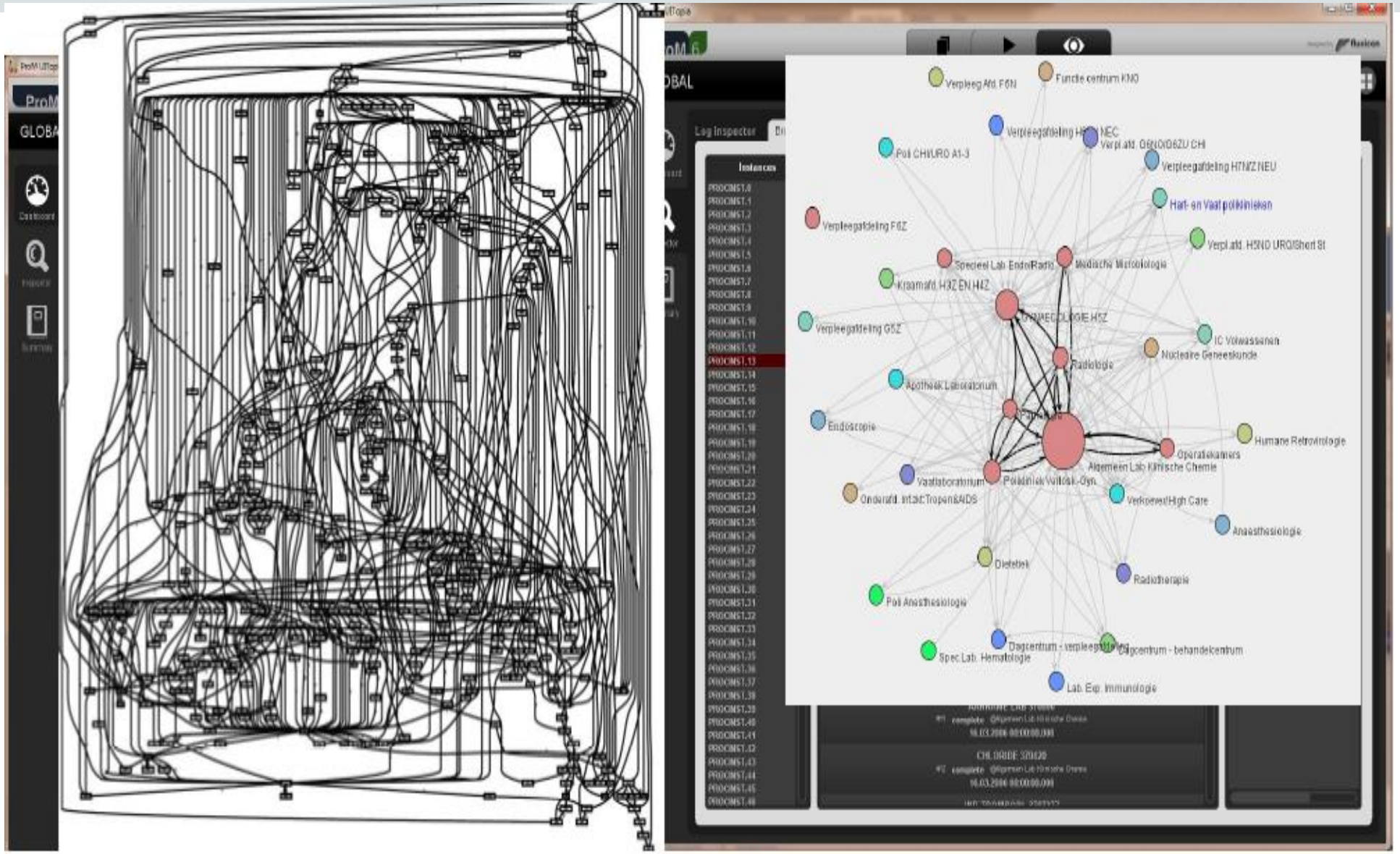
Example Process Discovery
(Dutch housing agency, 208 cases, 5987 events)

117315	110 Bepalen leegstandsoort	16.05.2007 14:06:23
117315	120 Plannen eindinspectie	16.05.2007 14:36:01
117315	130 Is het opleveringsformulier ondertekend ?	23.05.2007 09:41:40
117315	150 Is er sprake van ZAV ?	23.05.2007 09:41:51
117315	170 Aanpassen plattegrond	23.05.2007 11:57:18
117315	180 Aanpassen woningwaardering	23.05.2007 09:42:37
117315	190 Actualiseren huurprijs	23.05.2007 09:48:23
117315	200 Toewijzen woning/bedr.ruimte/gar/berg/park/ops	23.05.2007 09:48:29
117315	210 Registreren voorl. huurovereenkomst +afdrukken	10.09.2007 16:24:36
117315	220 Is contract getekend en geld ontvangen ?	11.09.2007 14:56:18
117315	240 Definitief maken Huurovereenkomst	31.03.2008 16:17:12
117315	250 Aanpassen factureerafspraak	09.09.2008 15:39:59
117315	260 After sales	09.09.2008 16:51:24
117315	270 Archiveren nieuwe verhuring	10.09.2008 07:52:08
117315	300 Is eindinspectie uitgevoerd ?	07.06.2007 14:47:04
117315	340 Zijn er nieuwe of niet herstelde gebreken ?	07.06.2007 14:47:06
117315	400 Beoordelen/wijzigen leegstandsoort	07.06.2007 14:51:16
117315	410 Is opleveringsformulier ondertekend ?	07.06.2007 14:51:26
117315	430 Aanmaken werkopdracht	11.06.2007 09:21:39
117315	440 Worden er bonussen/ kosten toegekend ?	11.06.2007 09:21:49
117315	460 Opstellen eindnota	08.08.2007 16:18:26
117315	470 Archiveren huuropzegging	09.08.2007 14:42:23
119763	010 Registreren huuropzegging	09.05.2007 11:19:14
119763	030 Vastleggen toekomstige adres	09.05.2007 12:25:01
119763	050 Inplannen afspraak 1e inspectie	09.05.2007 11:59:52
119763	060 Aanmaken bevestigingbrief / huuropzeggingform.	09.05.2007 12:31:57
119763	070 Is 1e inspectie uitgevoerd ?	16.05.2007 13:04:26
119763	100 Gereedmelden 1e insp. / Voorcalculatie maken	16.05.2007 13:43:39
119763	110 Bepalen leegstandsoort	16.05.2007 13:43:28
119763	120 Plannen eindinspectie	16.05.2007 13:42:58
119763	130 Is het opleveringsformulier ondertekend ?	16.05.2007 13:34:49
119763	150 Is er sprake van ZAV ?	16.05.2007 13:34:56





EXAMPLE PROCESS DISCOVERY FOR HOSPITAL(627 GYNECOLOGICAL ONCOLOGY PATIENTS, 24331 EVENTS)



Replay

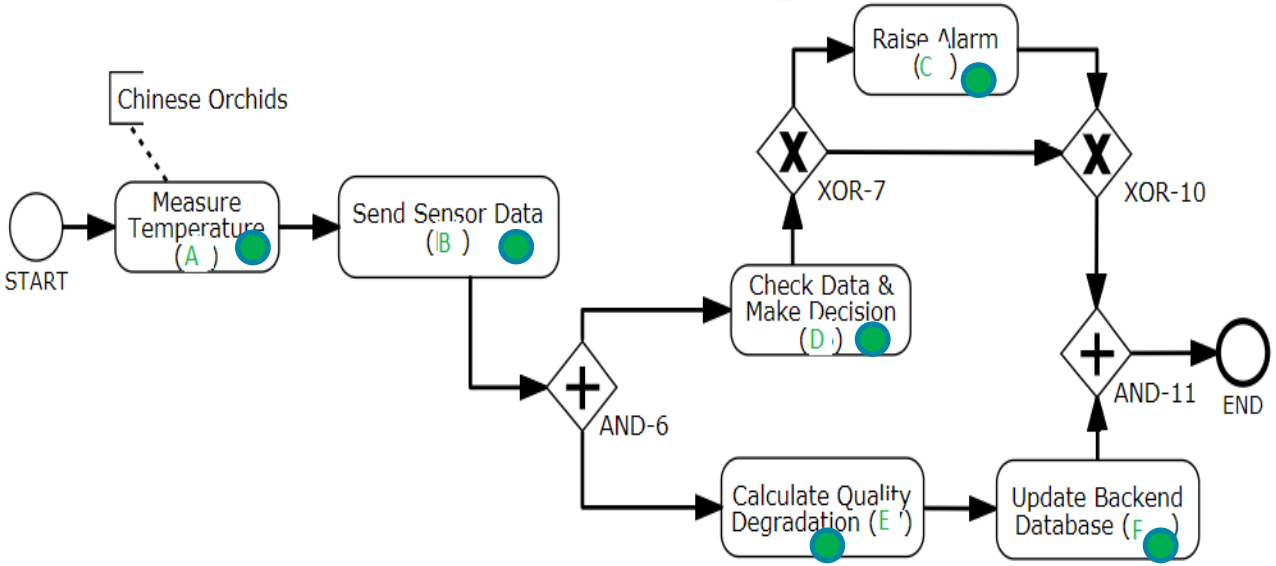
Case	Activity	Timestamp	Resource
432	register travel request (a)	10-3-2014:8.15	John
432	get support from local manager (b)	10-3-2014:8.25	Mary
432	check budget by finance (d)	10-3-2014:8.55	John
432	decide (e)	10-3-2014:9.35	Sue
432	accept request (g)	10-3-2014:9.45	Mary

©Wil van der Aalst & TU/e (use only with permission & acknowledgements)

Reality

A B D E F C

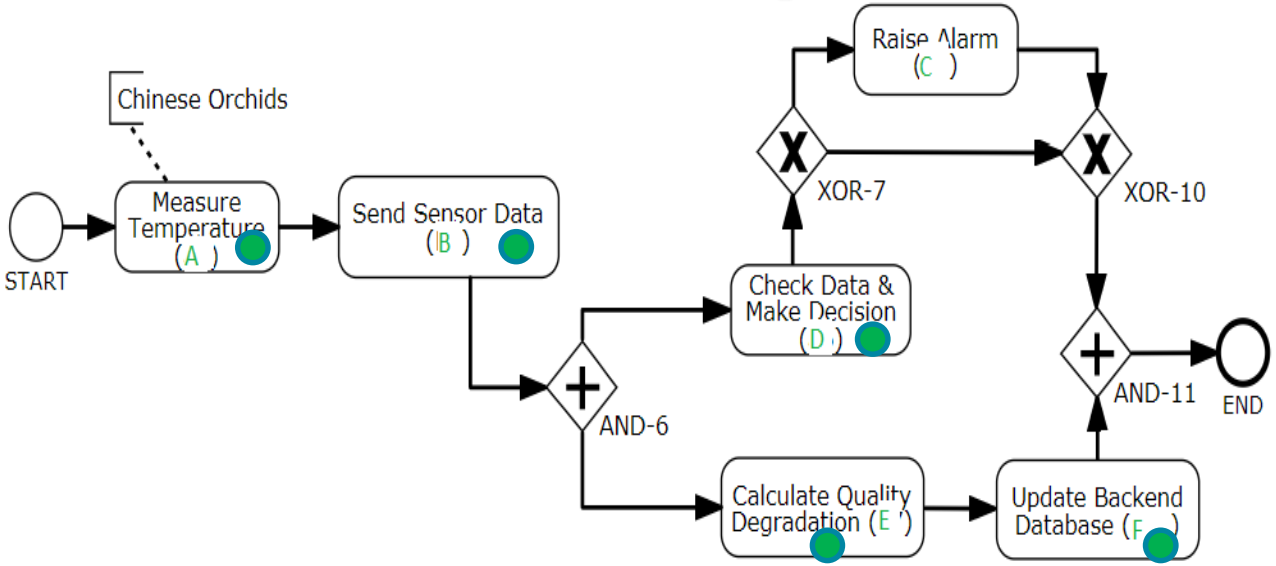
Assumption



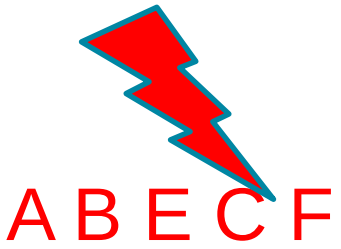
Reality

A B E D F

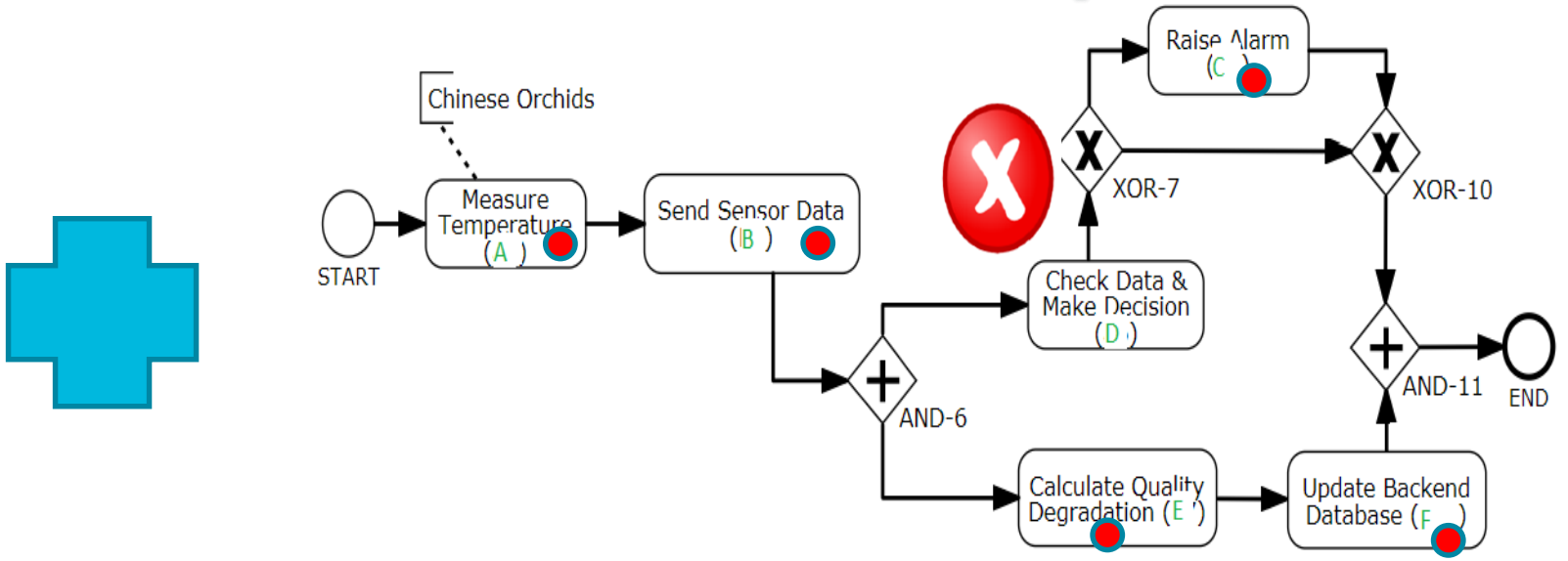
Assumption



Reality



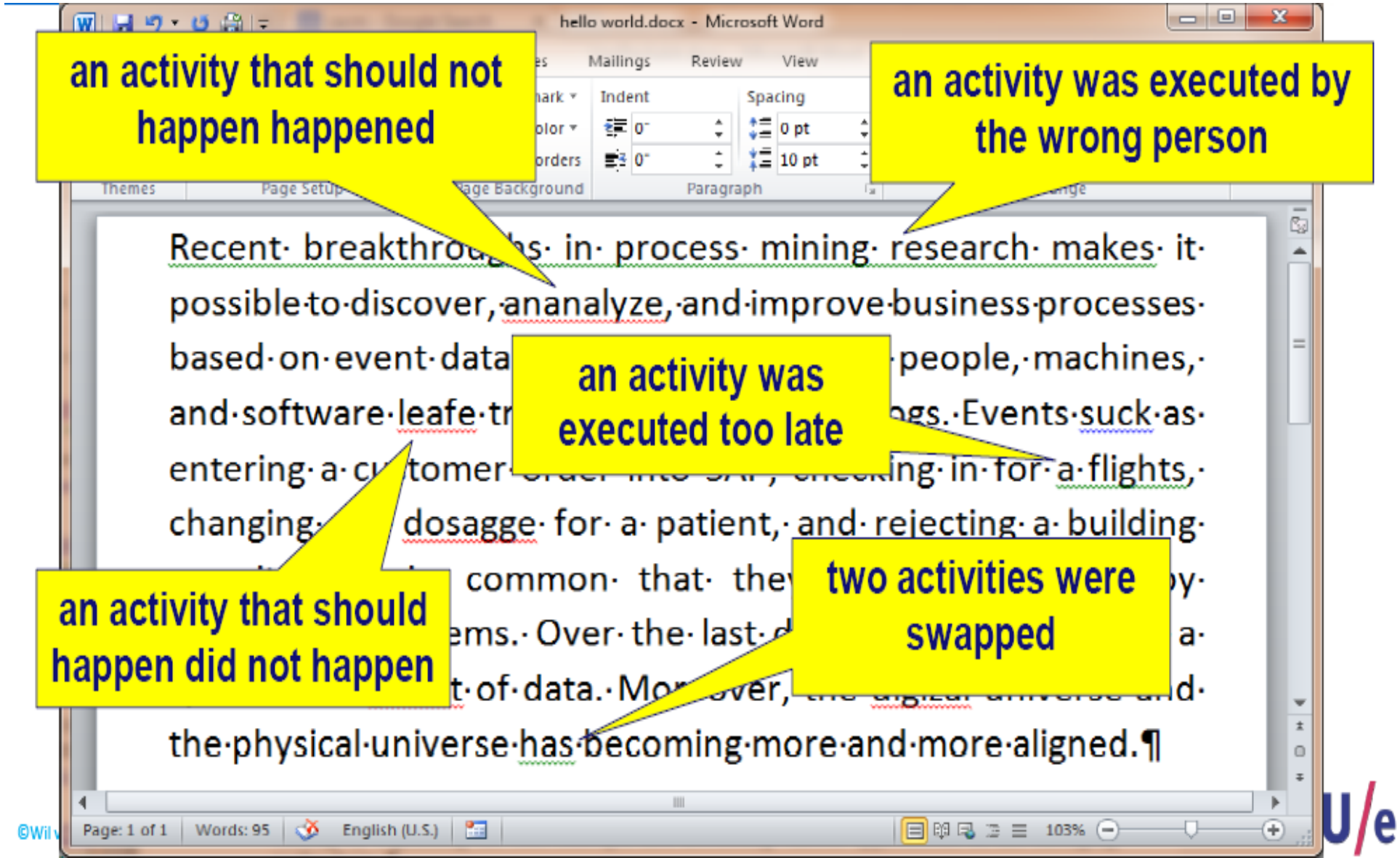
Assumption

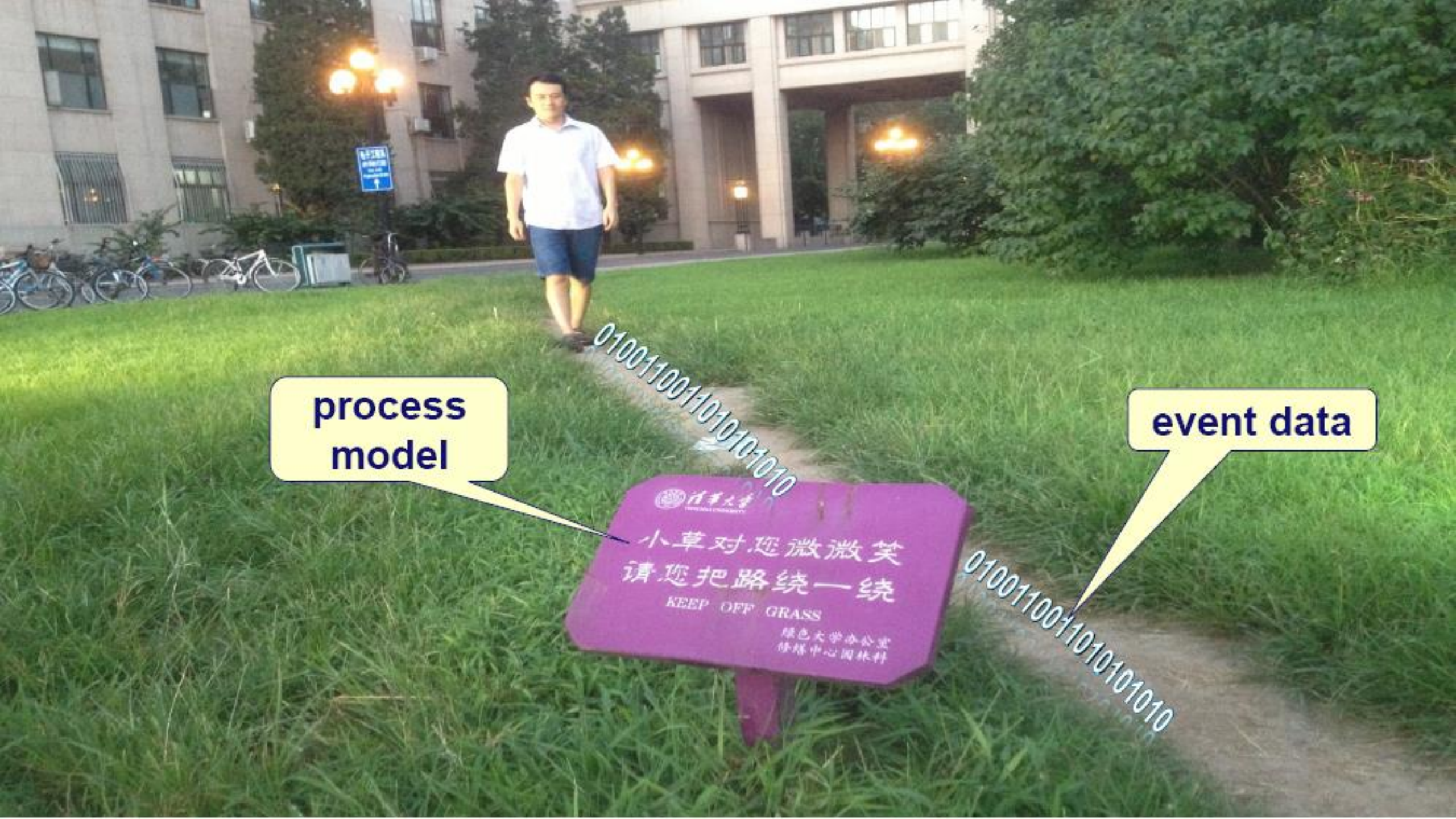


Process Conformance

- Which traces are possible
- Detect deviations
- Enact corrections actions
- Enact re design for evolution needs

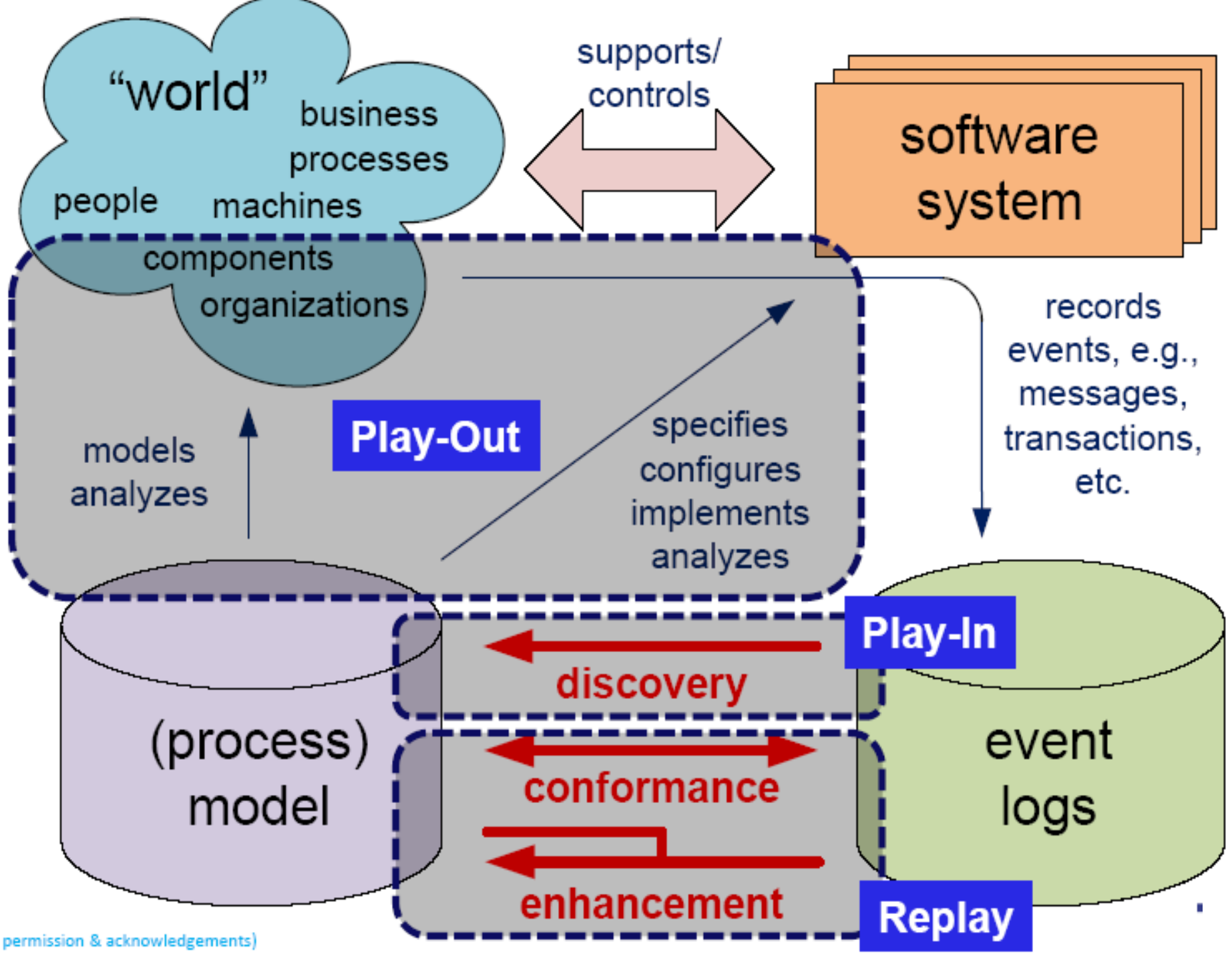
CONFORMANCE CHECKING IS LIKE SPELL CHECKING




process model
01001100110101010101
event data
01001100110101010101
小草对您微微笑
请您把路绕一绕
KEEP OFF GRASS

event data
0100110101010100
process model or information system
Picture by Koen Olsthoorn

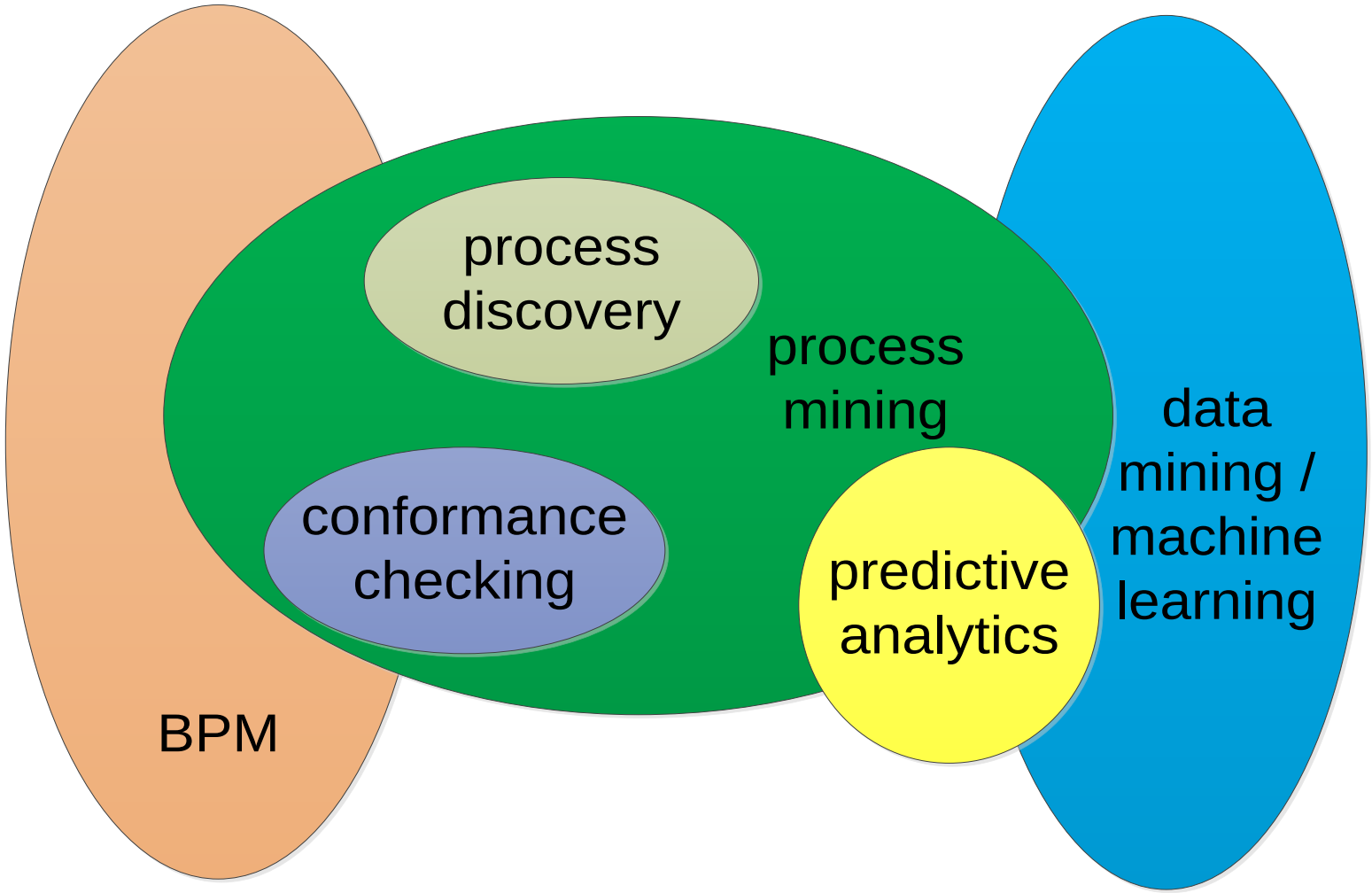
Overview



©Wil van der Aalst & TU/e (use only with permission & acknowledgements)

Thank you

THE BROADER BUSINESS PROCESS INTELLIGENCE (BPI) FIELD



- UW Health : University of Wisconsin-Madison
  - How to best allocate operating room space for unscheduled (urgent & emergent) surgical cases added to the schedule
- Deutsche Bank
  - Regional Process Variation
  - Escalation Loops: The “Ping-Pong effect”
- HOSPITAL UNIVERSITARIO LUCUS AUGUSTI
  - Reducing Cancer diagnostic delay
- ZIMMER BIOMET
  - Visualization of material flows

- UW Health : University of Wisconsin-Madison
  - How to best allocate operating room space for unscheduled (urgent & emergent) surgical cases added to the schedule
- Deutsche Bank
  - Regional Process Variation
  - Escalation Loops: The “Ping-Pong effect”
- HOSPITAL UNIVERSITARIO LUCUS AUGUSTI
  - Reducing Cancer diagnostic delay
- ZIMMER BIOMET
  - Visualization of material flows

It is the process stupid!

In the end it is the process that matters (and not the data or the software).

Not just patterns and decisions, but end-to-end processes.