DE LA RECHERCHE À L'INDUSTRIE

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TOPIC GROUP ON ROBOTICS FOR HEALTHCARE

Rovereto , 13th March 2014

Christophe Leroux, CEA LIST

OBJECTIVES OF THE WORKSHOP

Objectives

- Organize the activities of the Topic Group on Robotics for Healthcare regarding the research roadmap in robotics

SUMMARY OF THE WORKSHOP

13h30-14h00 Framing the activities of the Topic Group

14h00-15h30 Presentation of some end user needs and some manufacturers expectations

15h30-16h00 Break

16h00-17h00 Round tables on step changes for future calls

17h00-17h30 Feedback from round tables, debriefing, and proposition of step changes for ict24 call. Wrap up of the meeting.

FRAMING THE TOPIC GROUP ACTIVITIES

- **Robotics PPP, objectives of the TG on robotics for healthcare,**
- **Definition of terms (step changes, etc.)**
- **Presentation of actions made and documents produced**

WHAT IS A PPP?

PPP: Public-Private Partnership

- **European Commission,**
- **euRobotics aisbl**

Drive research in robotics in Europe

- **Elaboration of SRA, MAR,**
- **Preparation of call**

High level document

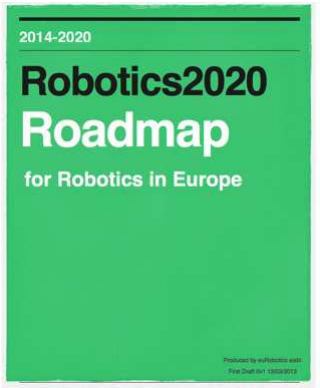
➡Overview of opportunity

➡Overview of technology

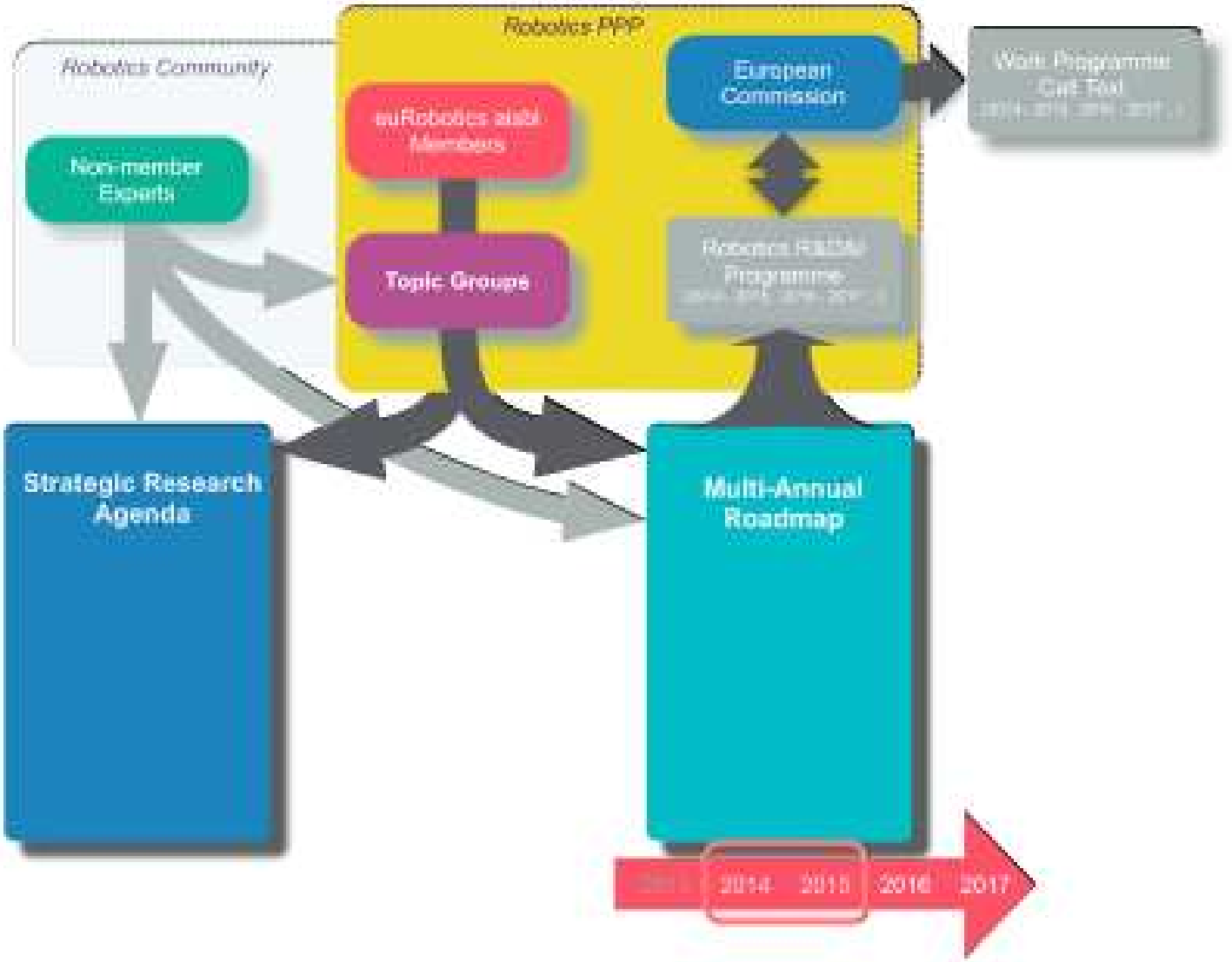
Technical detail

➡Updated each year.

➡Tracks trends.



PPP PROCESSES



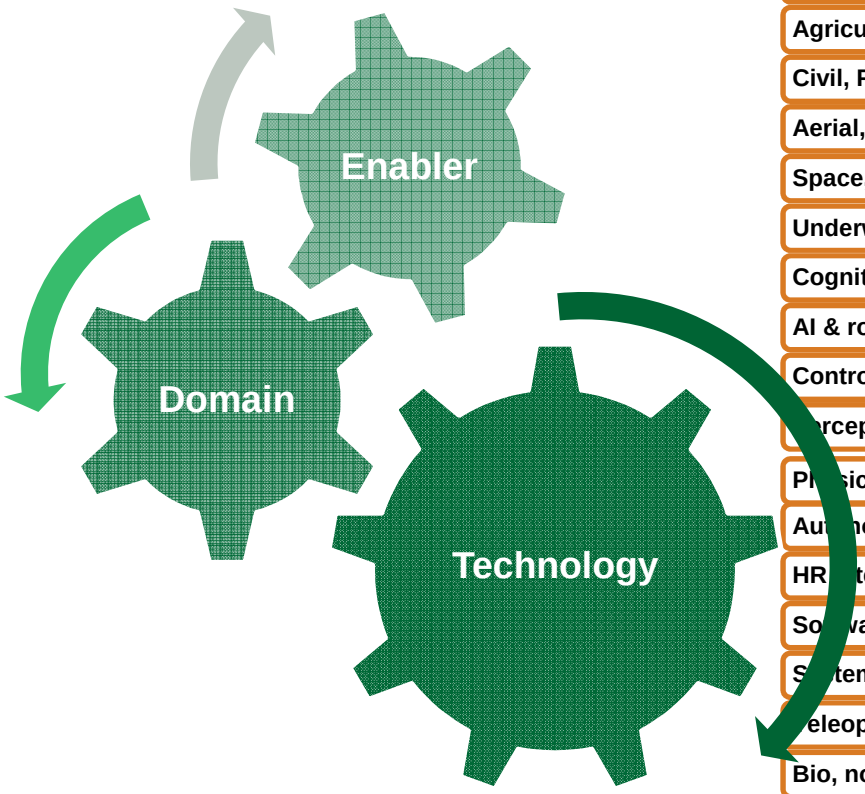
TOPIC GROUPS WITHIN PPP PROCESS

In charge of updating the SRA and MAR (2014)

GA voting on the priorities according to BoD recommendations

Overlap, cooperation between TG

Categories



- Healthcare, C Leroux, CEA,
- Companion for AL, Paolo Dario, SSSA,
- Industry, Björn Matthias, ABB
- Agriculture, Thilo Steckel, CLAAS
- Civil, F Fusco, Alenia Aermacchi
- Aerial, Annibal Ollero, U Sevilla
- Space, Thomas Vögele, DFKI
- Underwater, M Caccia, CNR-ISSIA
- Cognitive system and AI, G Metta, IIT
- AI & robotics, A Saffiotti, Orebro,
- Control,
- rception, Michael Suppa, DLR
- Pl sical HRI, S Haddadin, DLR
- Au nom navigation, JP Gonzalez ASCAMM
- HR teraction, ?, not in Leuven,
- So ware engineering, H Bruyninckx KUL
- S tem Engineering, R Lafrenz, TUM
- eleoperator, Manuel Ferre UPM
- Bio, not in Leuven
- Mini, Nicolas Andreff ,FEMTO
- ELS issues, Leroux, CEA
- Benchmark, ?, not in Leuven,
- Training education, J Hallam,
- Standardization, FhG IPA,

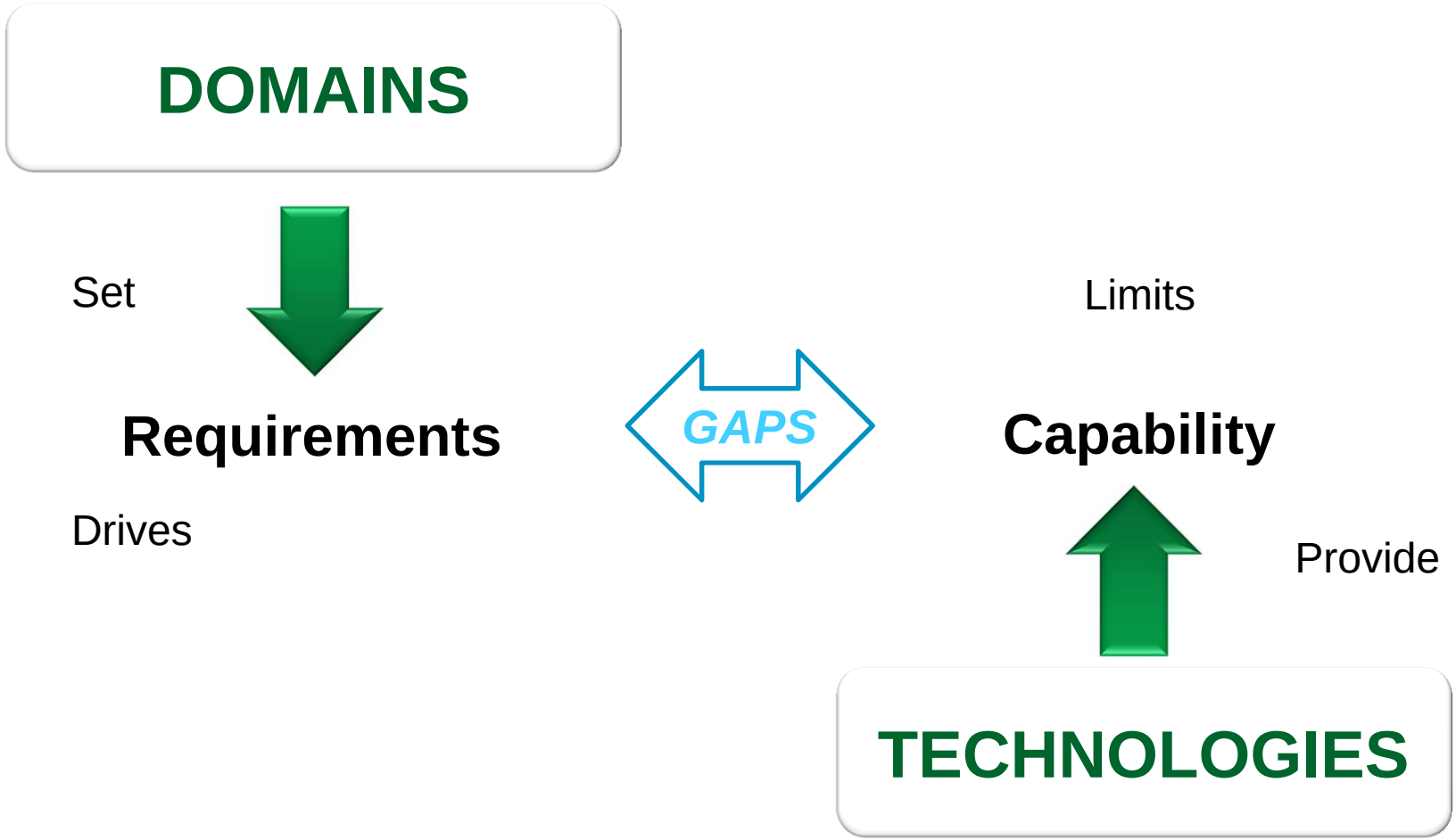
ROBOTICS FOR HEALTHCARE TOPIC GROUP

- Surgical and operating room robotics
- Rehabilitation robotics
- Assistive robotics
- Prevention robotics

TOPIC GROUPS ADMINISTRATION

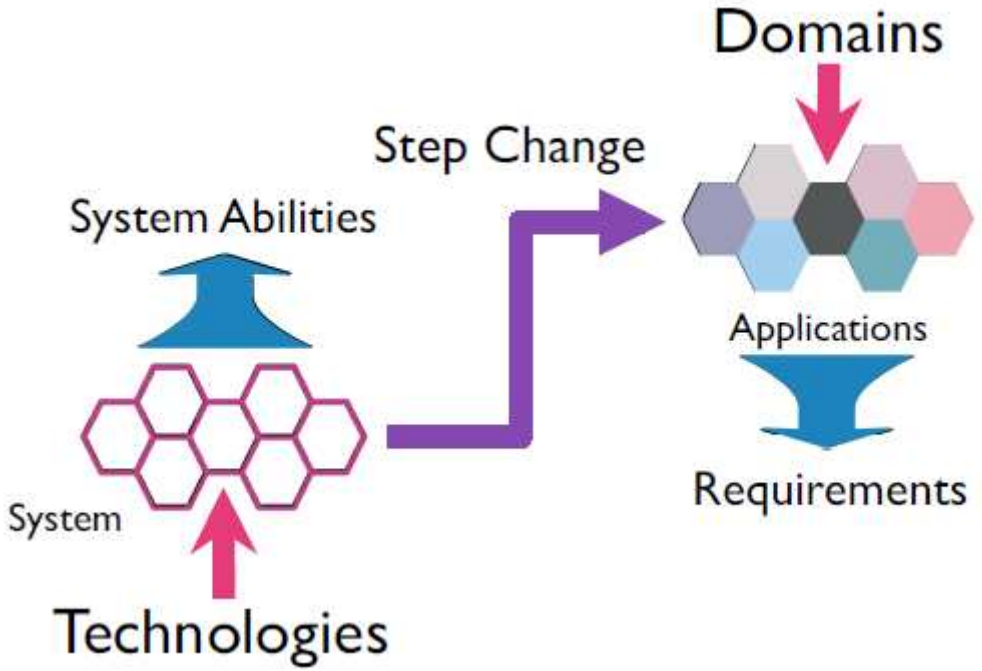
- Topic Group Coordinator (TGC) and Topic Group Deputies (TGD).
- Topic Group Coordinator (TGC) from a member of euRobotics aisbl.
- TGs should provide input to each MAR Cycle.
- TG will be allocated an euRobotics aisbl a mentor from board of directors.
- euRobotics will organise at least two workshops per MAR cycle for TG members.
  - **One to review the outcome of a funding cycle**
  - **One to overview material prior to the MAR release, plus any others**
- TG contact point should maintain a mailing list for the TG members.
- TG Technical Activities Board (TG TAB) will oversee the operation of TG.
- euRobotics aisbl will provide access to a Wiki dedicated to each TG.
- Content and membership of this wiki is the responsibility of the TGC and TGD.

METHODOLOGY TO ELABORATE THE ROADMAP



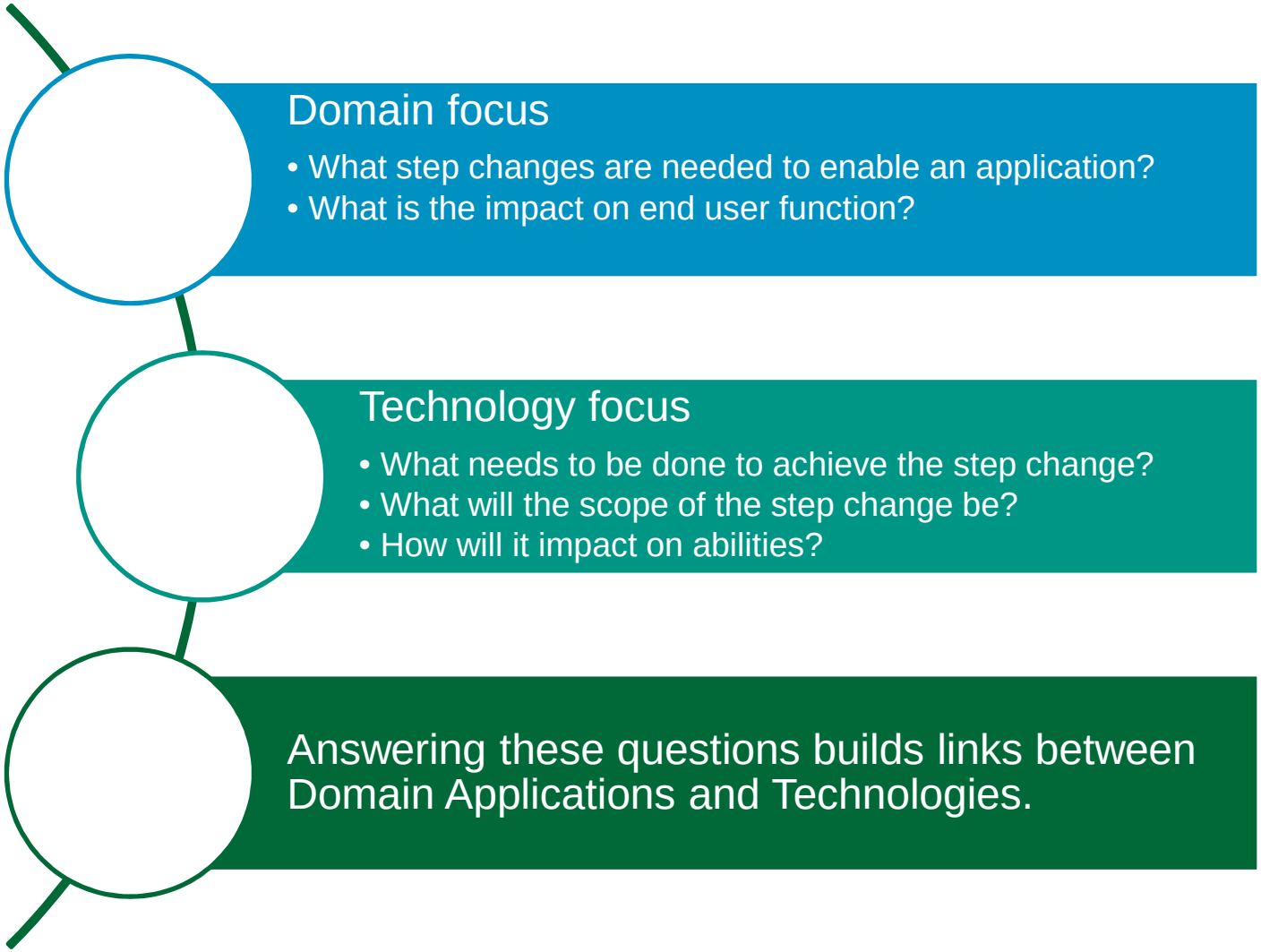
IDENTIFYING STEP CHANGES

"Step Change"
• **not** incremental improvement.
• significant improvement.
• enables new market opportunities.



An order of magnitude improvement.	cost reduction
	parameter improvement
	reduction in resource requirement
Or categorical step in capability	Moving from procedural to declarative controller
	Specification developed by reasoning rather than hand construction
	From rigid robots to joint compliant robots to segment compliant robots

IDENTIFYING STEP CHANGES



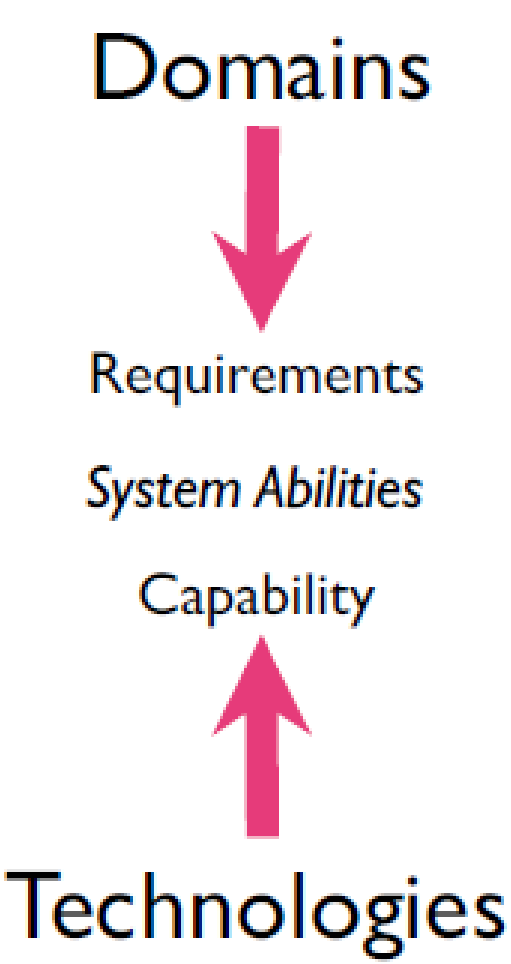
EXAMPLE OF STEP CHANGES

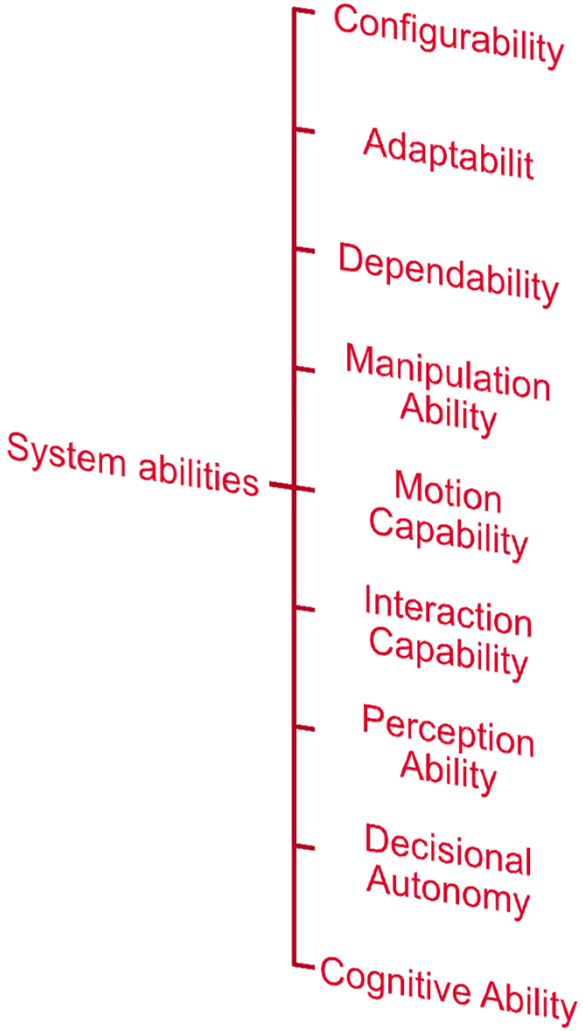
Mechatronic “step changes” from the MAR

- *Smarter mechatronic design*
- *Robust control methods*
- *Smarter Mechanical System Design*
- *Interface standardisation*
- *Modular mechatronic components*
- *Soft robotic systems*
- *Bio-compatible robotic components*
- *Reducing mechatronic component cost by a factor of ten*

Need to describe as *a step from X to Y*

SYSTEM ABILITIES LEVELS





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EXAMPLE: TRACKING ABILITY

Level 0 - No tracking

- Some robots will be able to carry out their tasks without any tracking ability.

Level 1 - Tracked Feature Perception

- Features detected in the sense data are tracked over time. The tracking of features is used to build internal models of the environment. The tracking of markers in the environment is equivalent to tracking derived features.

Level 2 - Static Object tracking

- It is possible to track a detected object. The detected location of the object can be maintained with a reliability and accuracy that is compatible with the task.

Level 3 - Dynamic object tracking

- It is possible to identify an object and track it using sense data. As the object moves the system is able to disambiguate the motion of the robot from the motion of the object.

Level 4 - Flexible object tracking

- It is possible to identify a flexible or deformable object and track it.

Level 5 - Animate objects

- It is possible to identify and track an animate object and extract the pose of the object.

WHY ARE SYSTEM ABILITY LEVELS IMPORTANT?

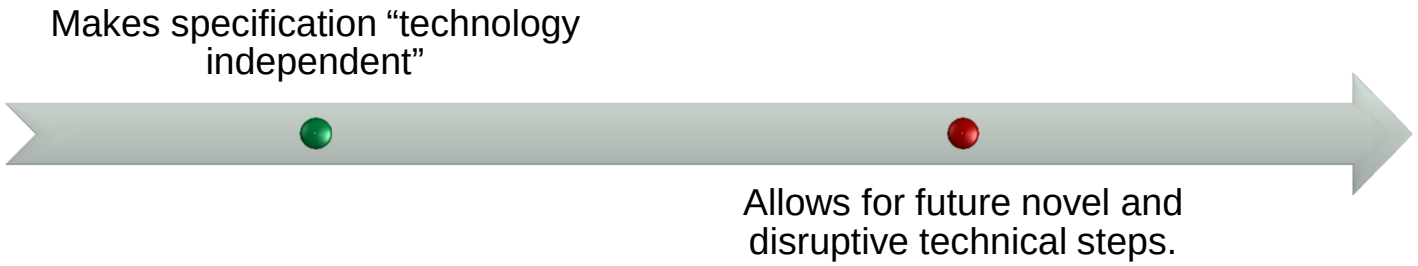
To define MAR we need to be able to find “paths” between technology and possible applications.

- **To link expected applications to developments in technologies.**
- **Without exactly defining the applications.**

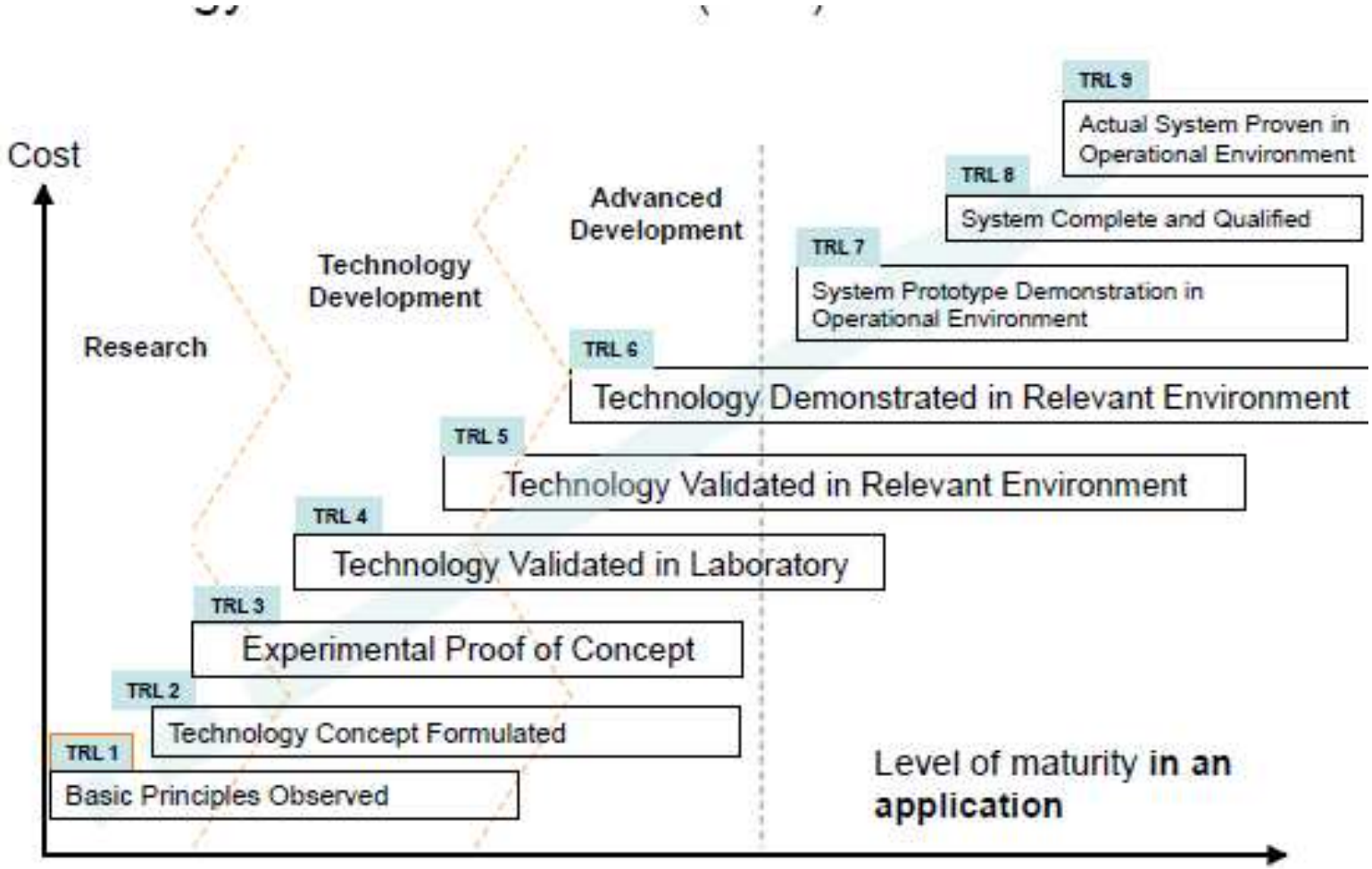
Difficult to identify exactly which technologies will enable an application.

- **Different combinations may work equally well,**
- **or the key technology may not yet exist.**

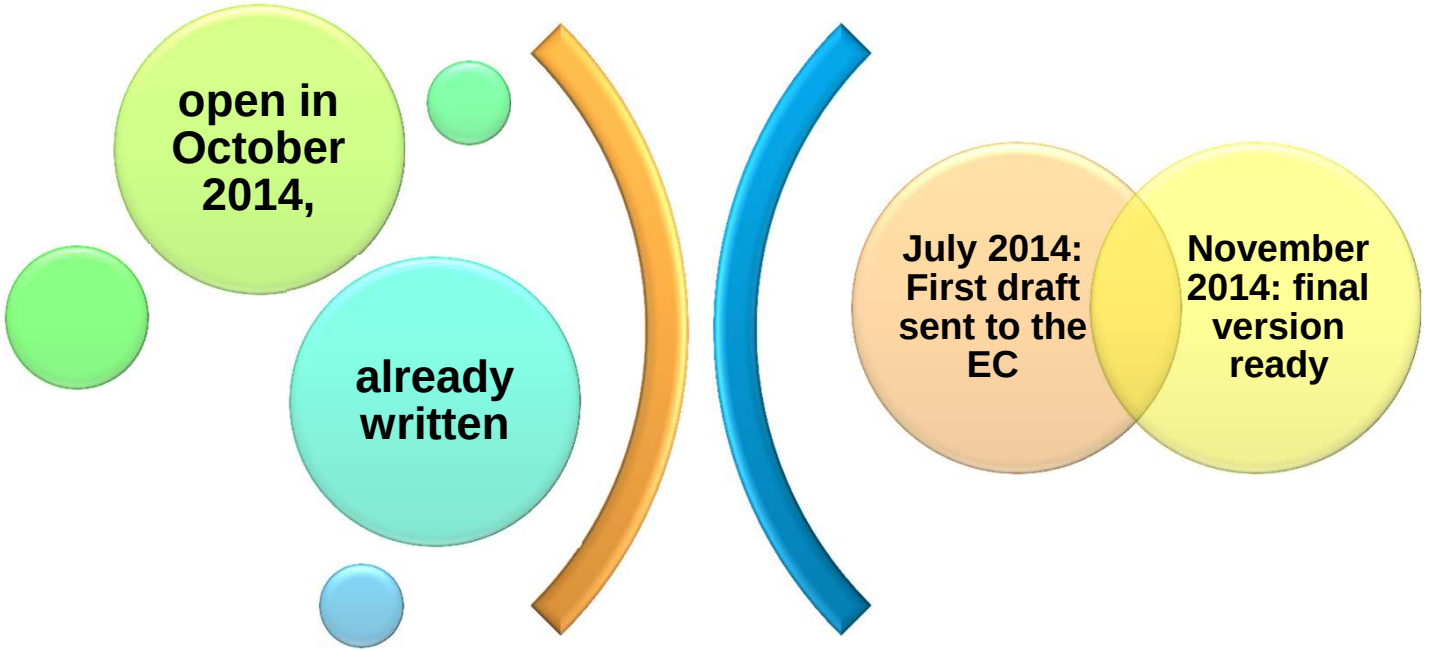
Easier to identify relationship between system ability levels and application requirements.



TECHNOLOGY READINESS LEVEL



ROBOTICS PPP



Call 2015

Calls 2016, 2017

MAR domain

MAR product vision

- All purpose surgical robot for operating room
- Rehabilitation robot
- Fitness coach
- Assistive robot

EXPERT VIEW POINT

Presentation of point of view from some experts

Break

Round table

EXPERT VIEW POINT

Presentation of point of view from some experts

Break

Round table

DOCUMENTS

MAR domain

MAR product vision

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Updating of WIKI

WRAP UP

- Unwinding
- Proposition of step changes for next calls
- Scheduling of future activities
- Wrap up of the meeting