Understanding the RoboEarth Cloud
a party with smart owls, big elephants, and twisted snakes

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RoboEarth Quick Facts

• Objective: Building an Internet for Robots
• Funding: EU 7th Framework, ~4 mil. Euro
• 6 Partners: TUM, Uni. Stuttgart, TU/e, ETHZ, Uni. Zaragoza, Philips
The RoboEarth Team
The Building Blocks of the RoboEarth Cloud

- Language
- Storage
- Computation
RoboEarth Language

RoboEarth Language - Challenges and Solutions

How to represent?
KnowRob Ontology: OWL-based semantic representation

What to share?
Object Models
Environment Maps
Action Recipes

How to Reason?
KnowRob: Knowledge Processing Framework

How to Execute?
CRAM: Cognitive Robotics abstract knowledge

for details visit: http://knowrob.org
Neo: [aiming at an helicopter] Can you fly that thing?
Trinity: Not yet. [picks the phone, calls Tank]
Trinity: Tank, I need a pilot program for a B-212 helicopter. [Tank loads the program in Trinity's brain]
Trinity: [to Neo] Let's go.
Representation-Action Recipes

- Highlights
  - Ability to reason about the applicability
  - Ability to adapt
Representation-Action Recipes-Demo

PR2 serves a drink using RoboEarth...
RoboEarth Storage
RoboEarth Storage

- HDFS Fuse
- Hadoop Distributed file system
- HBase
- Sesame Server (OWL repo.)
- Web Interface (humans) / RESTful API (robot)
RoboEarth Cloud Engine

(a.k.a. Rapyuta)

More challenges along the way...

I wish RoboEarth did some processing..

Are you serious?

Can I join too?
Something missing?

RoboEarth Database

Action Recipes
Maps
Software Components
Objects

Clients

HAL

- Generic Software Components
HAL - Hardware Abstraction Layer
The Complete Picture!

RoboEarth Database

RoboEarth Cloud Engine

Action Recipes Maps Software Components Objects

Clients

HAL

▲ ■ ○ - Generic Software Components
HAL - Hardware Abstraction Layer
Turtlebot: Internet Edition

ASUS Xtion PRO (~200$)

ASUS USB-N53 (35$)

ODROID U2 (~90$)

connectivity ~90Mbps

Task: ETH Zurich office, Amazon Ireland server, map it in real time!
Turtlebot: Internet Edition
Secure, Light weight, ROS compatible computing environments with Linux Containers
Details

server 00

Master Task Set

server 01

Container Task Set

server 02

Container Task Set

LXC - Linux Containers

Environment EP

ROS node

ROS node

re_comm

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Other use cases

- Robot Networking
- rosbridge like functionality
- multi master functionality
Ongoing Work - Computation

- repo-server
- private virtual network
- public instance
Conclusion

• Discussed the core components
  • RoboEarth Language
  • RoboEarth Storage
  • RoboEarth Cloud Engine
• More details
  • http://roboearth.org/software-components
Thank you for your attention!

- Cloud Robotics Workshop

IROS 2013
Cloud Robotics Workshop
http://www.roboearth.org/iros2013

- Looking for developers, gajan@ethz.ch