

Developing OpenHRI -Open Source Software Components for Human Robot Interaction-

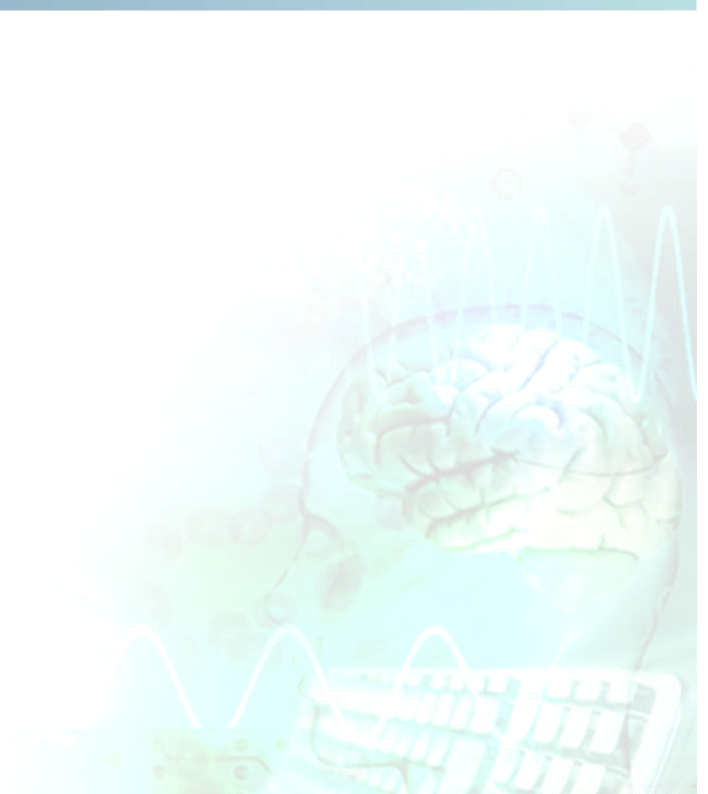
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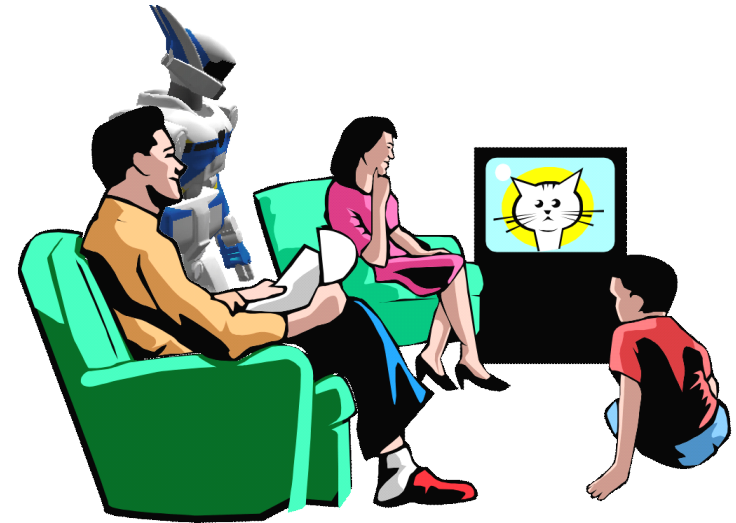
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Part 1: Overview



Background

- Industrial Robot
 - Expert Operator
 - Specified Action
- Personal/Service Robot
 - Naïve User=Operator
 - Various Situations and Tasks



- “Communication” is the key function.

Why Development of Communication Function is Difficult?

Reason: Requires Wide Range of Knowledge

- Audio Signal Processing
- Lexical Analysis
- Speech Recognition / Synthesis
- Dialogue, etc...

As a result...:

High development effort.

(When we develop from scratch...)

Low learning curve.

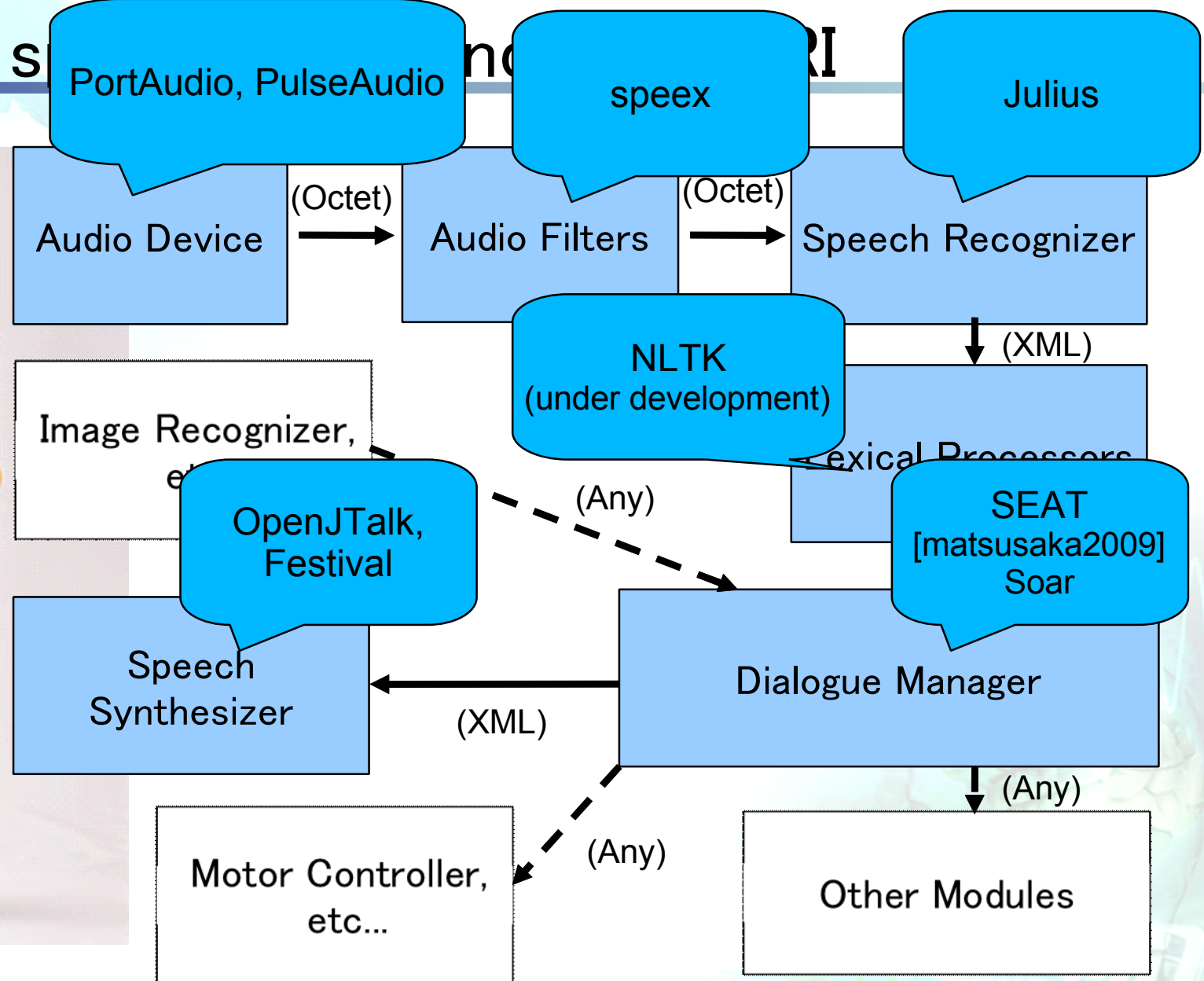
(Because we are not the professional in developing communication systems...)



OpenHRI

- Reference implementation of common interface specification defined in NEDO Intelligent Robot Technology Software Project (NEDO-IRTS).
- Integrate wide range of open source software based on RT-Middleware specification.

NEDO IRTS common interface



Application Examples



HRP-series:
Humanoid platform for general
tasks.



TAIZO:
Rehabilitation exercise
demonstration robot.
17 exercise + greet.



SmartPal™:
Object handling.
Navigation.



RH-1:
Office service robot.
Guide service, Control
TVs, etc...

OpenHRP:
Virtual simulator

[openhrrp-demo.](#)

Comparison to Previous Researches

	Auditory Components	Complete Communication System	Complete Robotic System	Support for Dialog Manager
HARK	○	△ (Julius-HARK)	×	×
ROS+HARK	○	○ (Pocket Sphinx, Flite)	○ (100 > components)	×
Galatea	×	○ (Julius, GalateaTalk)	×	×
OpenHRI	△ (less support for mic. array)	○ (Julius, OpenJTalk, Festival)	○ (200 > components)	○

Feature: Very Easy to Install

On Ubuntu (3 commands):

```
$ sudo apt-add-repository ppa:openhri/ppa
```

```
$ sudo apt-get update
```

```
$ sudo apt-get installopenhriaudio openhrivoice  
seatsat
```

→ Install all the dependencies.

On Windows (integrated installer):

```
http://openhri.net/getinstaller.php
```

→ Hit "Yes" on all the dialogs.

Feature: Standard Oriented Grammar and Tools

W3C-SRGS

```
<?xml version="1.0" encoding="UTF-8" ?>
```

```
<grammar>
```

```
  <rule id="greet">
```

```
    <one-of>
```

```
      <item>hello</item>
```

```
      <item>good afternoon</item>
```

```
      <item>good evening</item>
```

```
      <item>good bye</item>
```

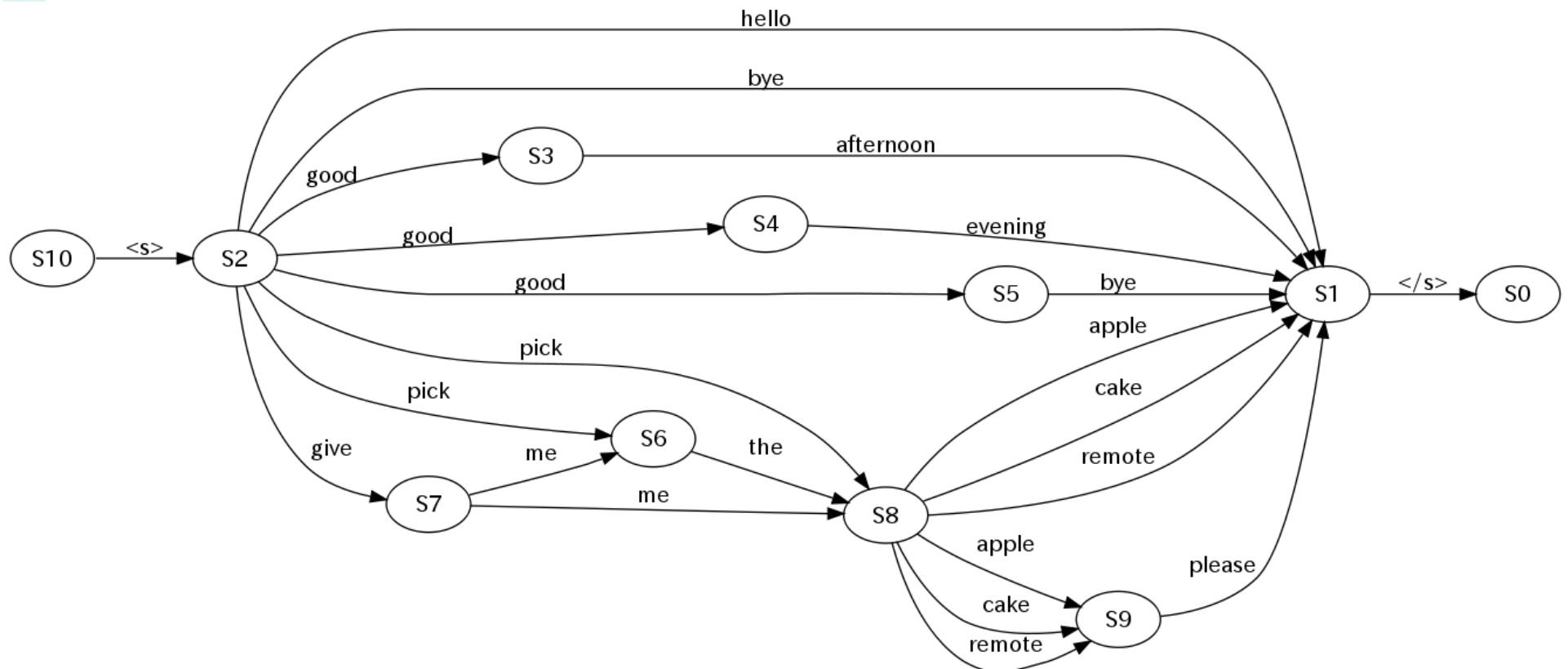
```
      <item>bye</item>
```

```
    </one-of>
```

```
  </rule>
```

Feature: Standard Oriented Grammar and Tools

W3C-SRGS



\$ srgstojulius sample.grxml | juliustographviz | dot

Feature: Multi-Lingual Voice Recognition and Synthesis

Currently Support:

- Japanese (OpenJTalk, Julius runkit)
- English (Festival, Julius acoustic model by voxforge)

Experimental Support:

- German (MARY, Julius acoustic model by voxforge)

Planned:

- Spanish, Korean, ...



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Part 2:

Development Techniques



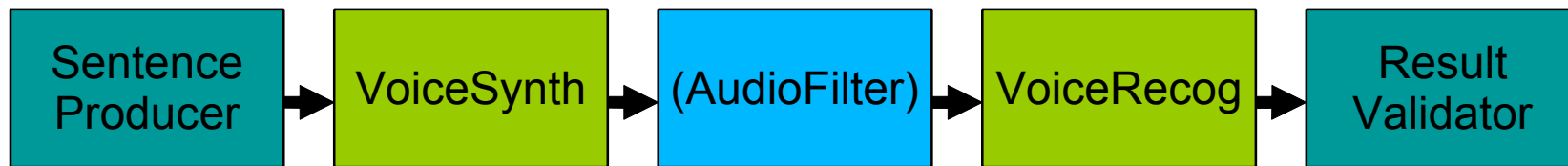
Multi-Lingual Testing

Normal system composition:



– Require native speakers to test each language.

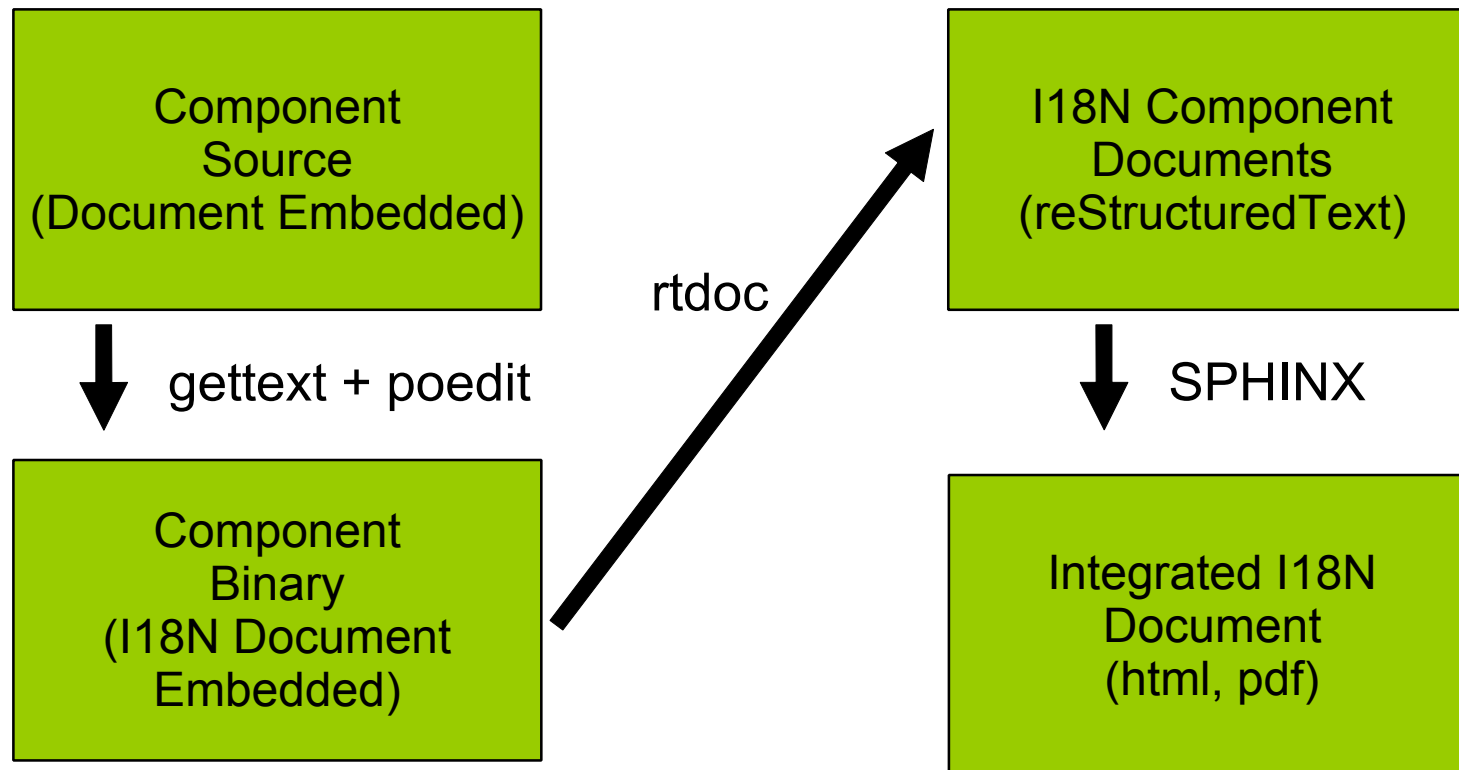
Make it inverse!



✂ Thanks to component architecture. We only have to modify component connections do this.

Document Automation

We use SPHINX and rtdoc (included in rtshell) to automatically generate component documents.



EchoCanceler

適応フィルタを使用した音響エコー除去コンポーネント

Vendor: AIST
Version: 1.06
Category: communication

Usage

```
:: $ echocanceler
```

Ports

Name	Type	Data Type	Ports Description
AudioDataIn	DataInPort	TimedOctetSeq	マイクからの音声データ入力
ReferenceAudioDataIn	DataInPort	TimedOctetSeq	音声出力コンポーネントからの音声データ入力
AudioDataOut	DataOutPort	TimedOctetSeq	音声データ出力
Parameter	DataOutPort	TimedDoubleSeq	適応フィルタの設定値



Configuration parameters

Configuration parameters

Name	Description
Gain	適応フィルタ倍率

Deployment

For Ubuntu system:

- Heavily rely on service of launchpad.net.

Upload the source package →

- 1) Compile the binaries for all the architectures.
- 2) Construct and host the debian repository.

For Windows system:

- In-house package update script.
- Heavily rely on full time programmer working for this project.
- [Work-in-progress] Automatic compilation and packaging.

Summary

Overview:

- OpenHRI is a complete, easy to install components to construct human robot interaction system.
- Common interface is standard oriented and shared with commercial software companies.

Development Techniques:

- Test is done by inverting the perceptual system.
- Document automaton by SPHINX, rtdoc.
- Deployment by launchpad, update script.

Next challenge and open question:

“How can we make this sustainable?”

NEDO's Strategy to Spread RT-Middleware Industry

