tf2: The future of tf

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ROSCon May 11th 2013

Outline

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What is tf2

A refinement of tf

- Cleaner dependencies
  - Templated API
  - Seperation of ROS and non ROS components
- First class support for python at the ROS level
- Remote querying mechanism not requiring full tf stream
- Support for static transforms

Implementation

- Templated TransformData method
- Templated conversion methods
- Internalized transform math
- Cleanly separated ROS and non-ROS components
- Action based remote query API
- Seperate `/tf_static` topic
- Removed support for tf namespacing (tf_prefix)

Data Conversions

If all messages define `toMsg` and `fromMsg` static methods.

```
#include ‘‘tf2_bullet/tf2_bullet.h’’
#include ‘‘tf2_geometry_msgs/tf2_geometry_msgs.h
#include ‘‘tf2_kdl/tf2_kdl.h’’
tf2::Stamped<btVector3> b(btVector3(1,2,3),
    ros::Time(), ‘‘my_frame’’);
geometry_msgs::Vector3Stamped m;
tf2::convert(b, m);

tf2::Stamped<KDL::Vector> k;
tf2::convert(b, k);
```

Transform Any Datatype

If a template specialization for doTransform<T> exists. You can simply use the following:

```
T& transform(T& in,
  string& target_frame, Time& target_time,
  string& fixed_frame, Duration timeout=0.0)
```

Combine templated API and conversion:

```
B& transform(const A& in, B& out,
  string& target_frame, Duration timeout=0.0)
```

Static Transforms

- Latched topic `/tf_static`
- Published once
- Assumed to be not changing therefore no time history stored.

Remote Query

Provide an action based remote query capability, giving client/server model. This has benefits including:

- Allow one process with a longer history
- Background monitoring scripts do not require a `/tf` subscription
- Enable querying of tf data from offboard the robot over low bandwidth links (aka wireless)

pr2_plugs

A test deployment to verify things

- Verified correctness
- Verified robustness

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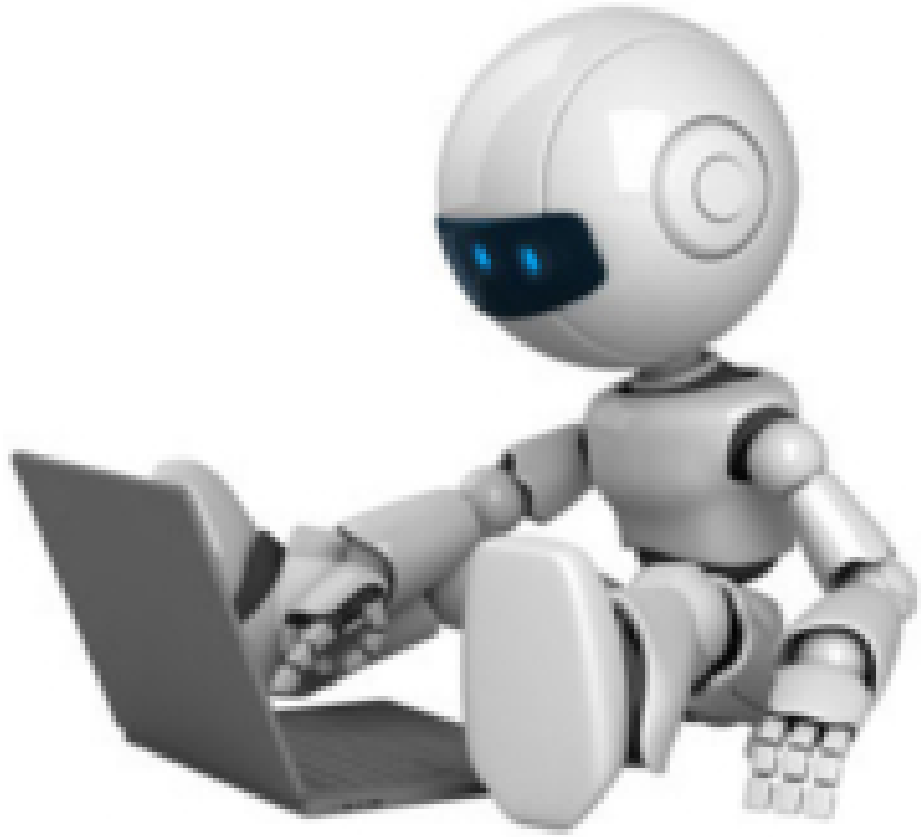
Robot Web Tools

Using transforms on the web

Major considerations

- Bandwidth
- Low level API access



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Outline

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Dealing with partitioned networks

Major considerations

- Bandwidth between robots
- Disambiguating similar robots

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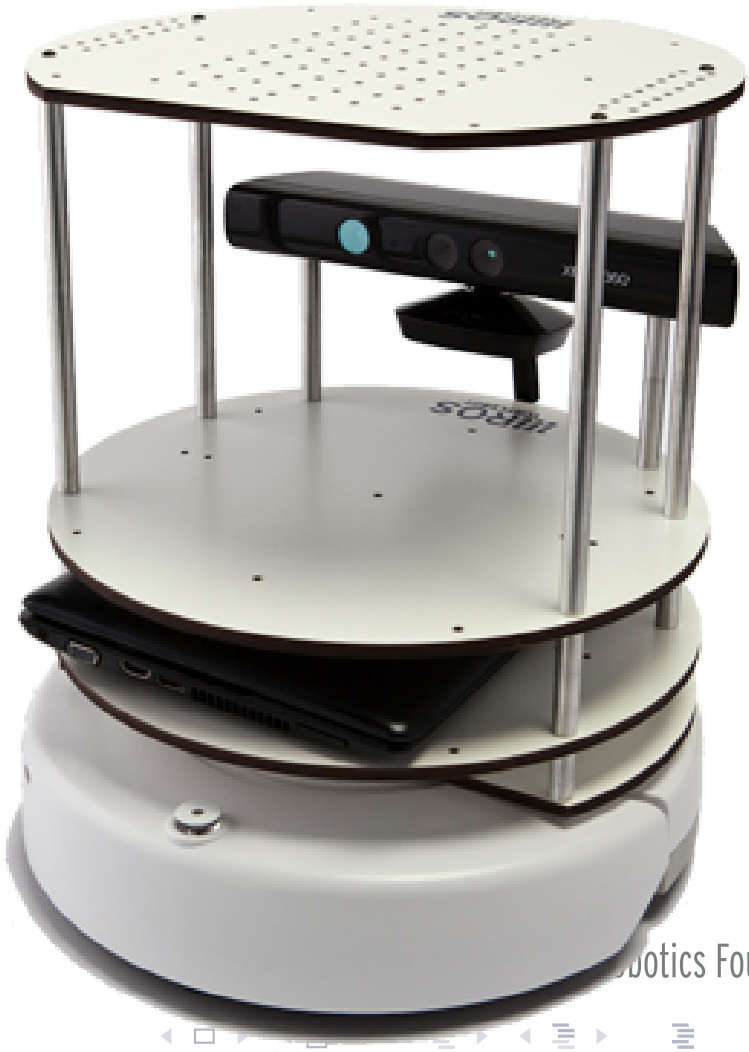
Proxying tf data

What parameters are important?

- What are the frames of interest?
- How are frames on one robot connected to the other robots?
- What update rate is required?
- How to balance bandwidth vs update rate?
- What latency is tolerable?

Multi Robot



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Multi Robot

Robot 1
Topics: `/tf` & `/scan`
Cordinate Frame: base_link

Robot 2
Topics: `/tf` & `/scan`
Cordinate Frame: base_link

How do you merge them?

- Forward /tf from one robot to another, rewrite frame_ids (`base_link` becomes robot1_base_link)
- Forward any data and rewrite specified fields which contains frame_ids (requires semantic interpretation)

Questions

Questions?
For full documentation see:
`http://www.ros.org/wiki/tf2`