

# MODULARITY & COMPOSITION: AUTOMATING SYSTEM SYNTHESIS

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# MODULAR COMPONENTS ARE INESCAPABLE

- Component-based systems track robotics research
  - Distributed
  - Prescriptive
  - Manual
  - Messy

# INTEGRATION IS UNIVERSAL

- Complex robot design can't/shouldn't be done in one-shot
  - Or by one person
- Integration provides a descriptive step
- Challenge is structure

# PARAMETERIZATION FOR INTEGRATION

- Track component development
- Descriptive
- Manual
- Generating structure in the face of limited resources

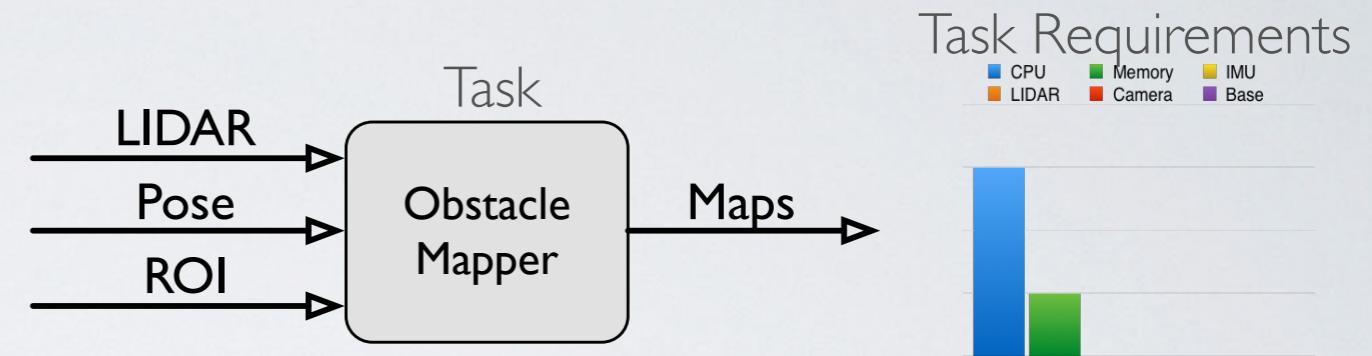
# Context-Aware System Synthesis

[[arXiv:1706.04580](https://arxiv.org/abs/1706.04580) cs.RO]

# COMPONENT MODEL

- Tasks & Devices

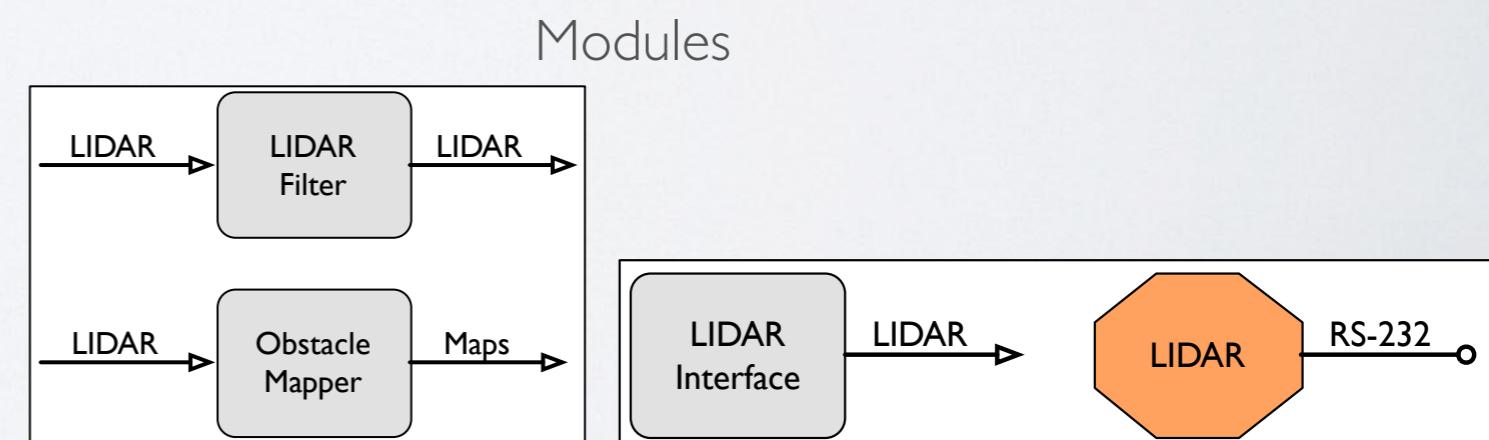
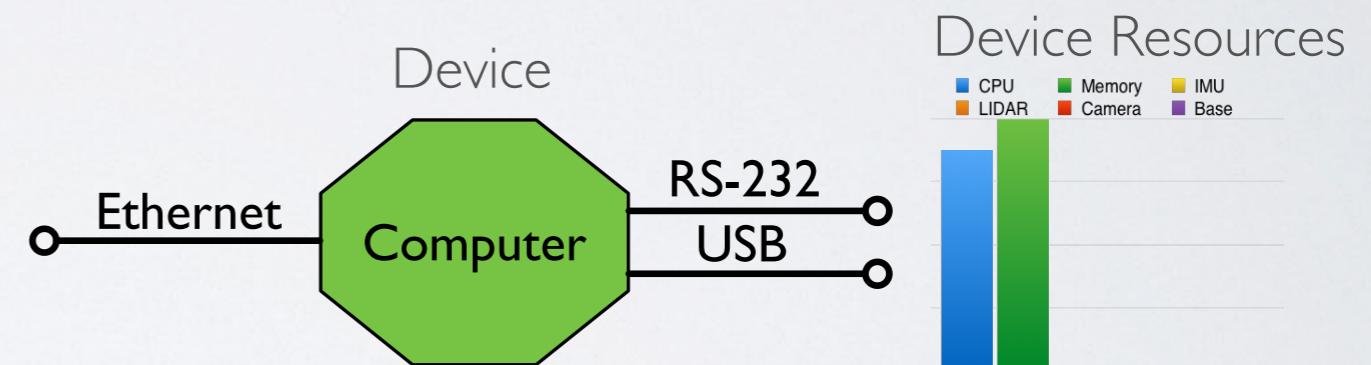
- Compositional



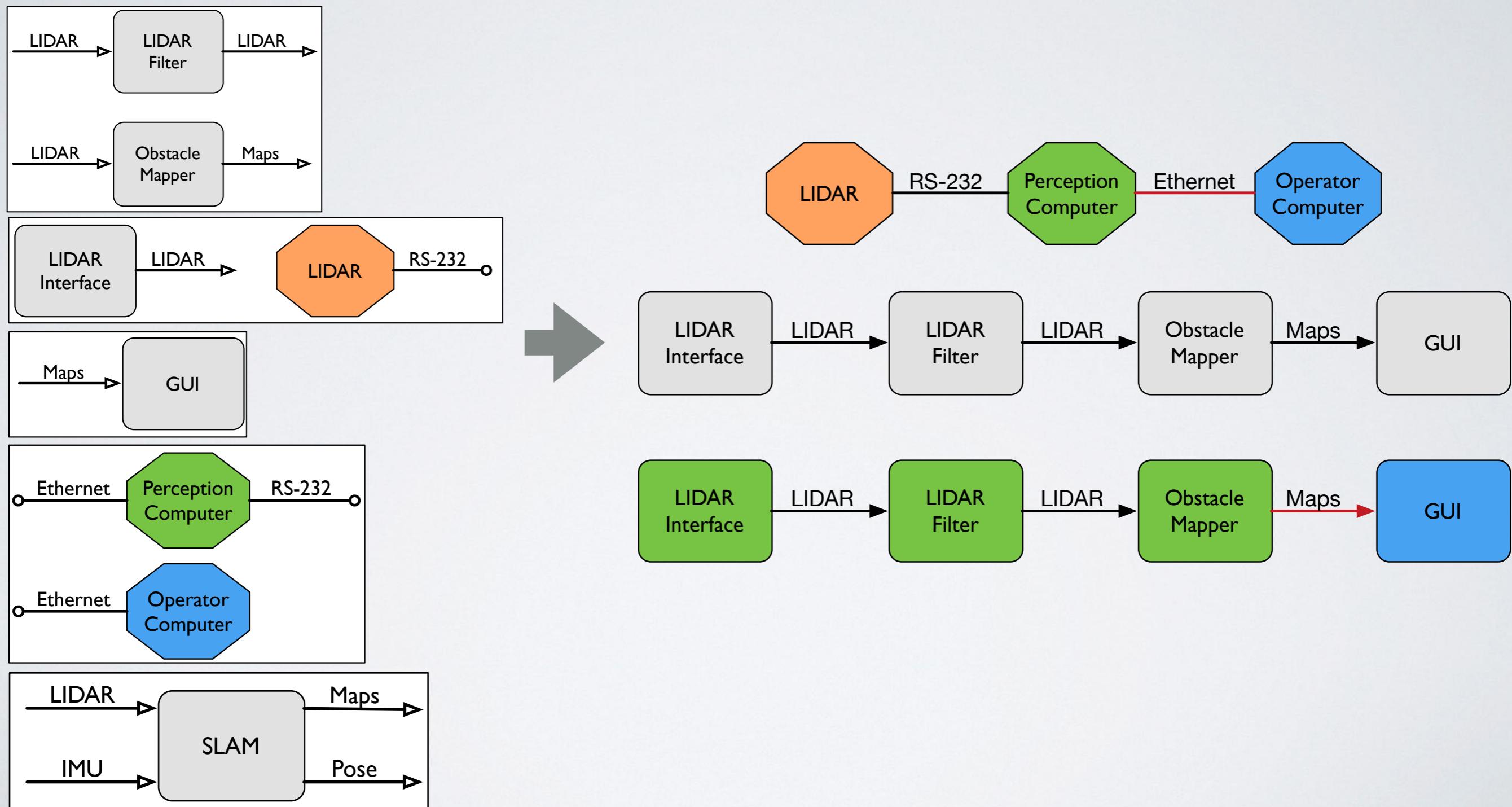
- Resources

- Modules

- Regularize functionality over components



# SYNTHESIS APPROACH



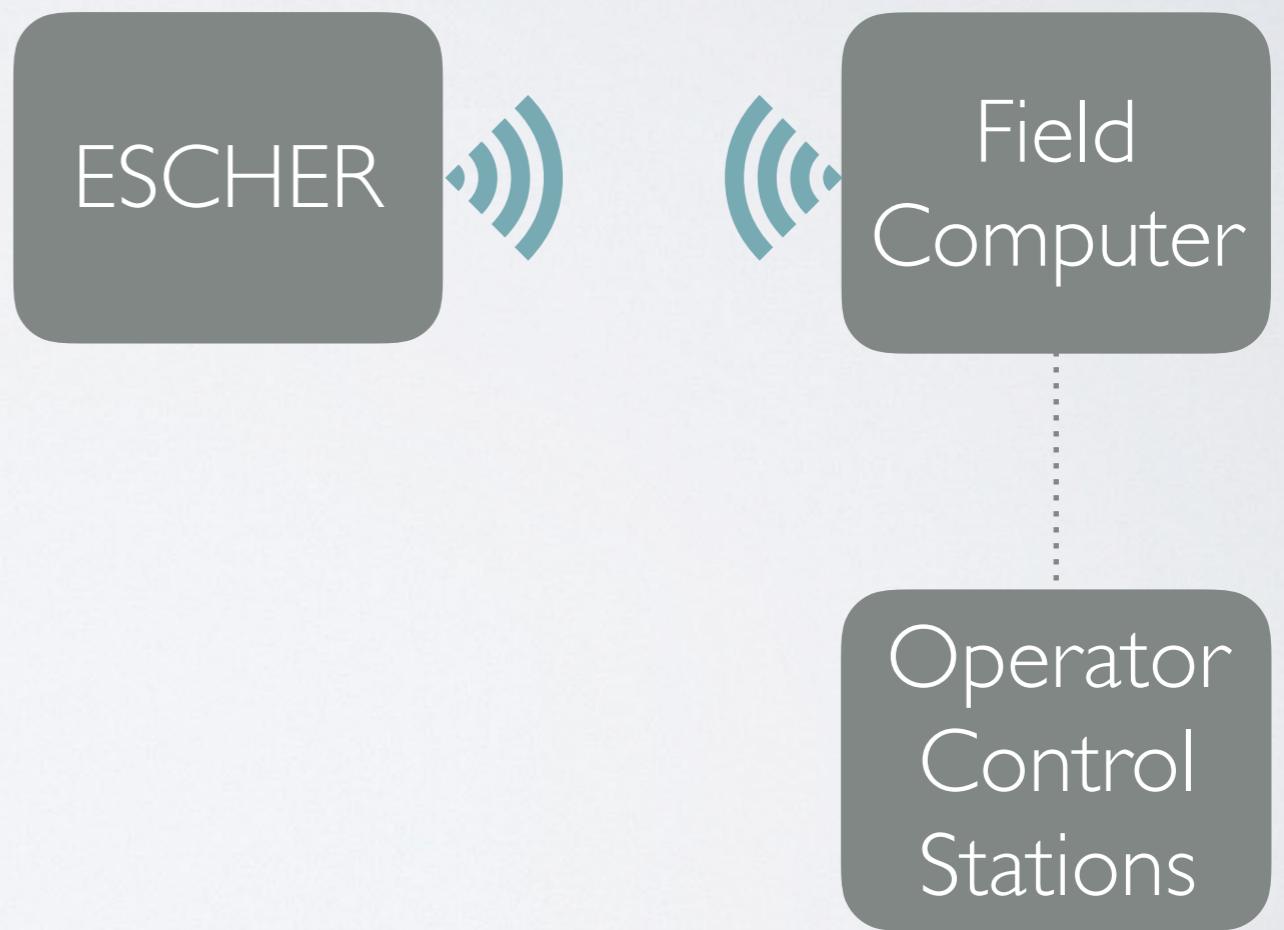
# ESCHER



Video Credit:VT

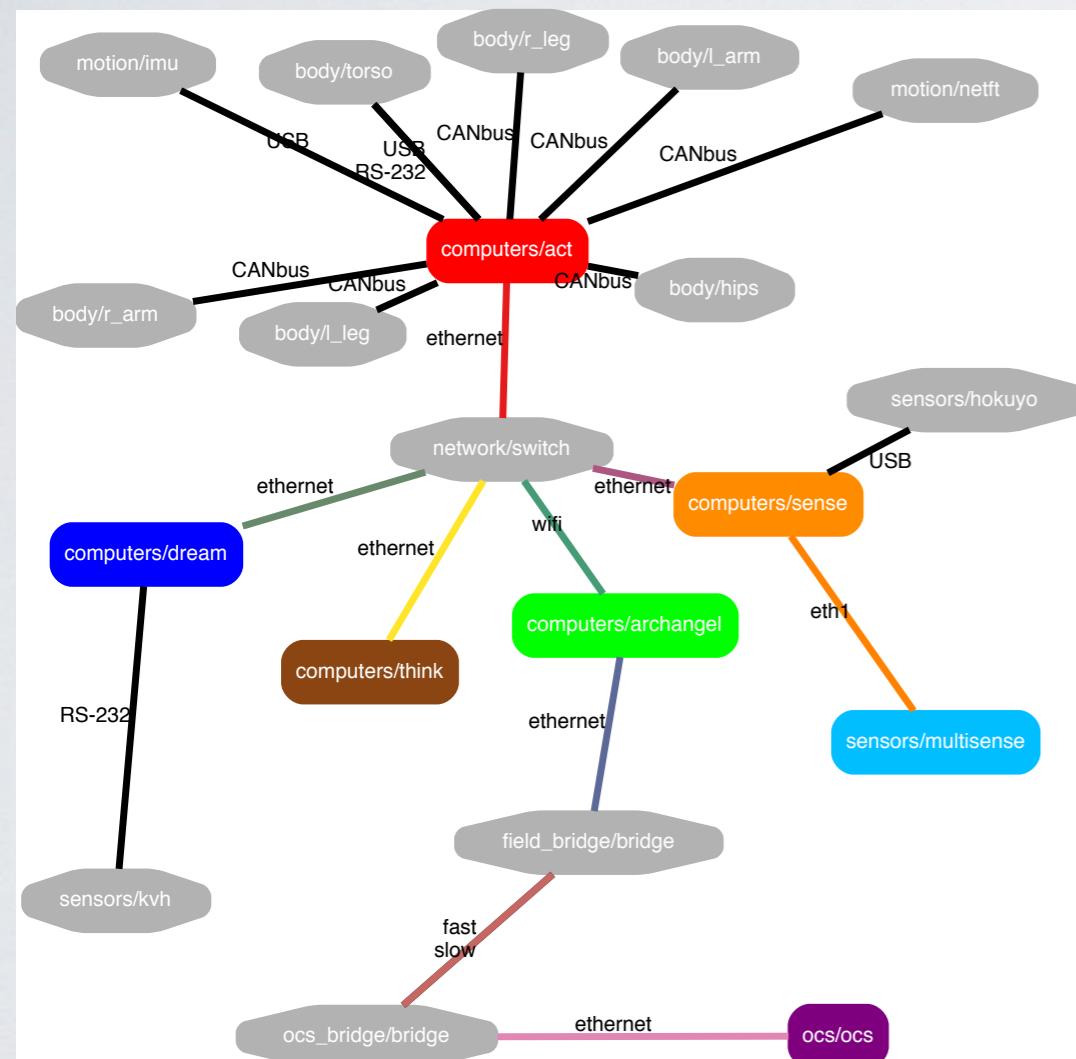
# ESCHER OVERVIEW

- Built for the DARPA Robotics Challenge
- Complex Computing Setup
  - Optional Field Computing
  - Degraded Communications
- Complex Software Design
  - >1.7 million SLOC
  - 3 middleware systems
  - 3 teams, 5 universities
- 9.120s for synthesis

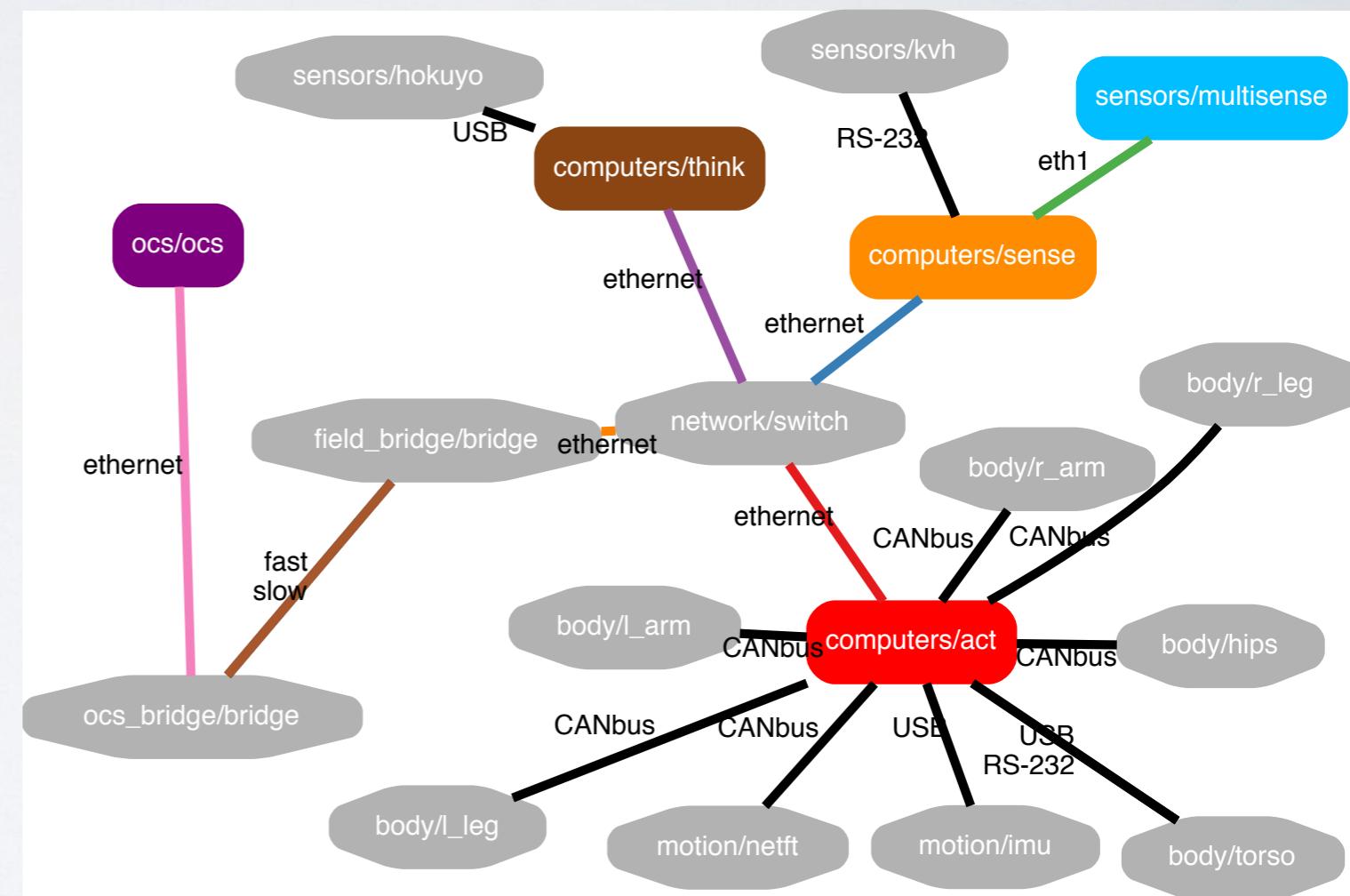


# ESCHER HARDWARE

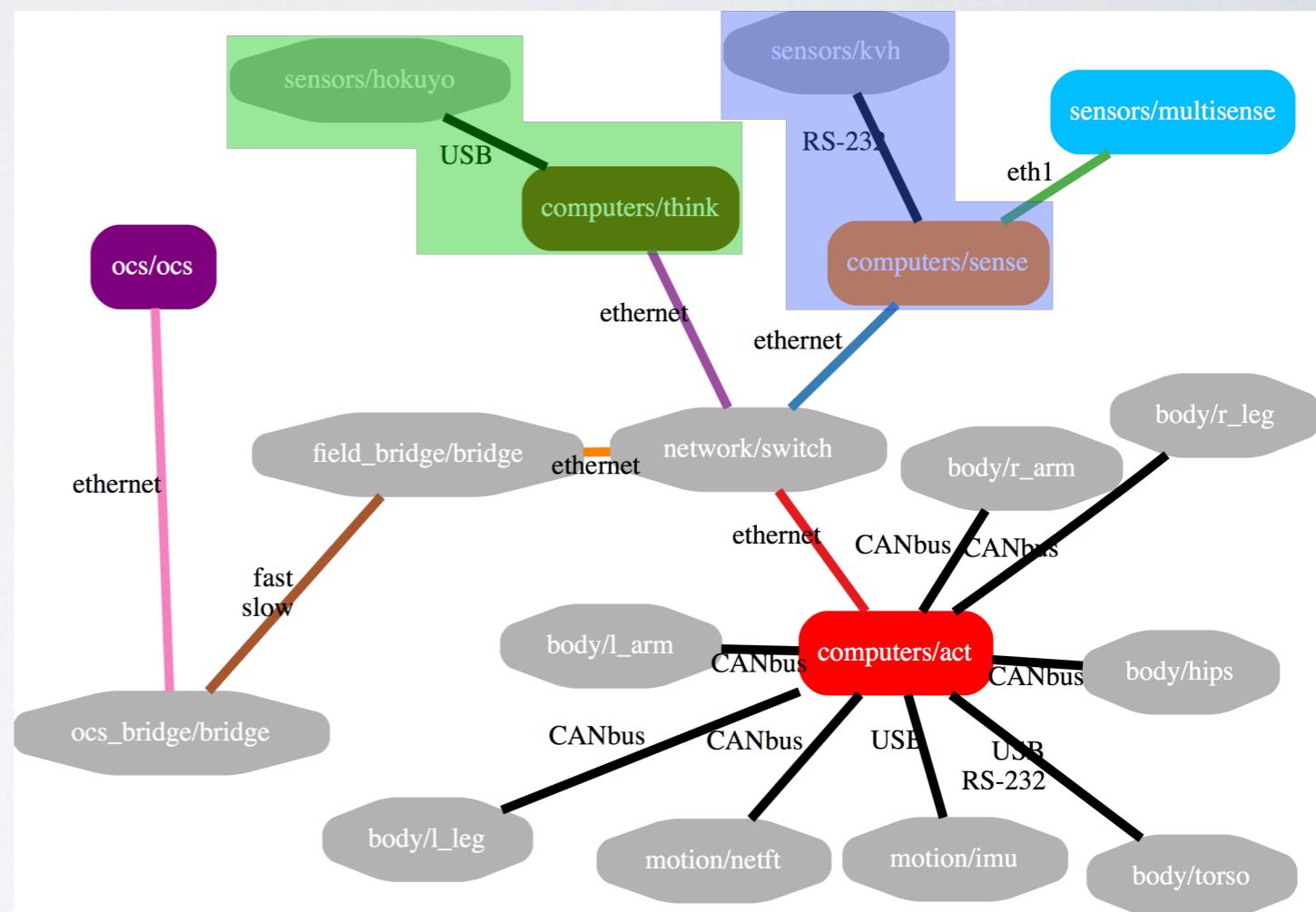
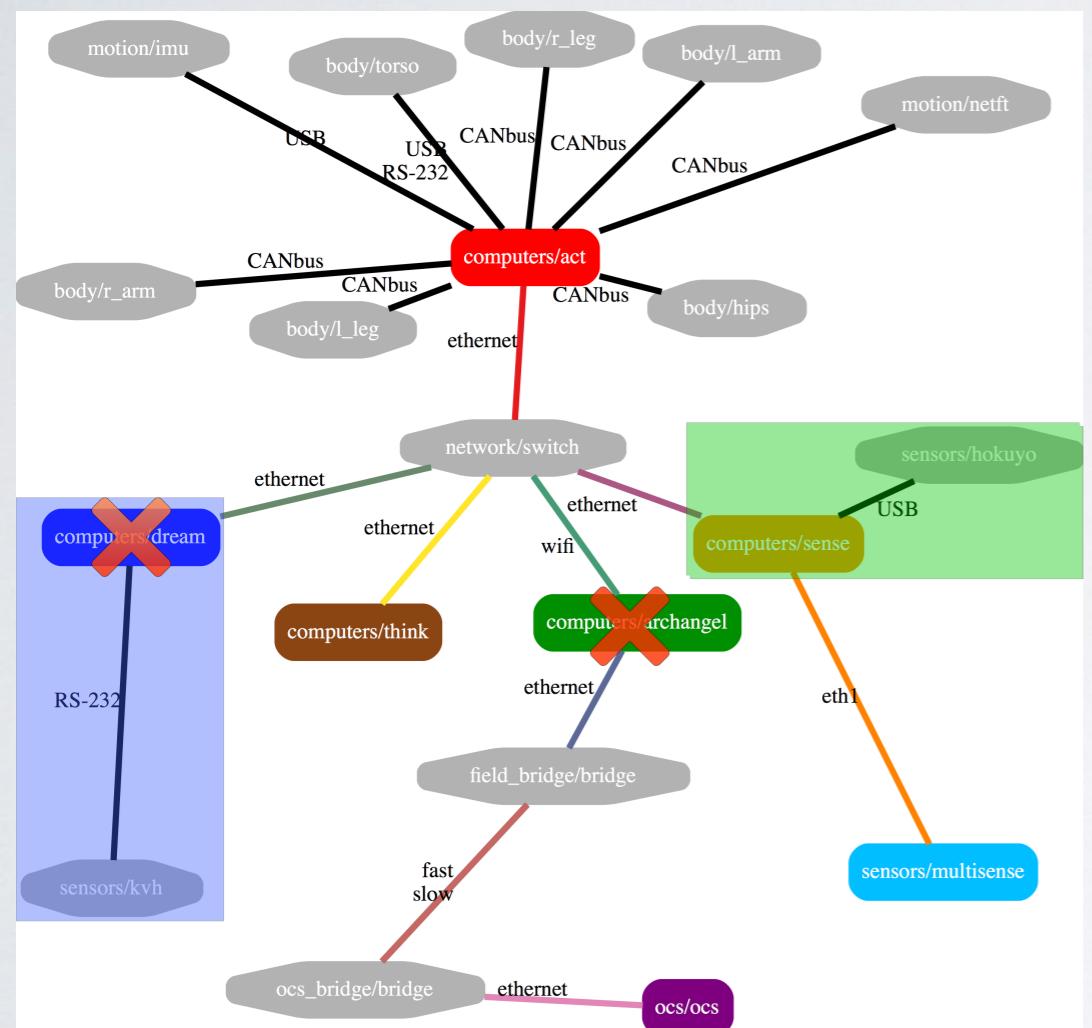
# Manual



# Synthesized

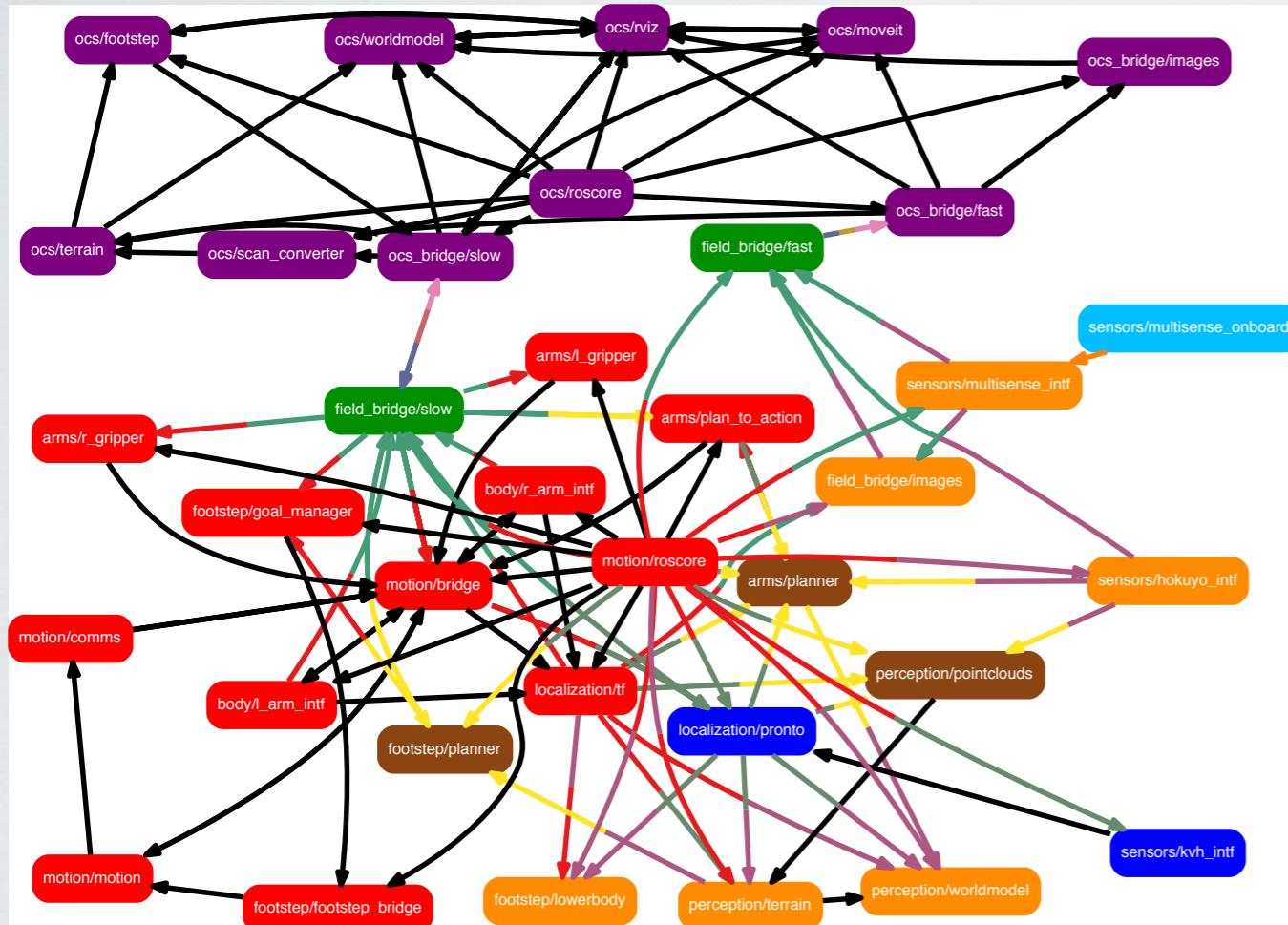


# HARDWARE DIFFERENCES

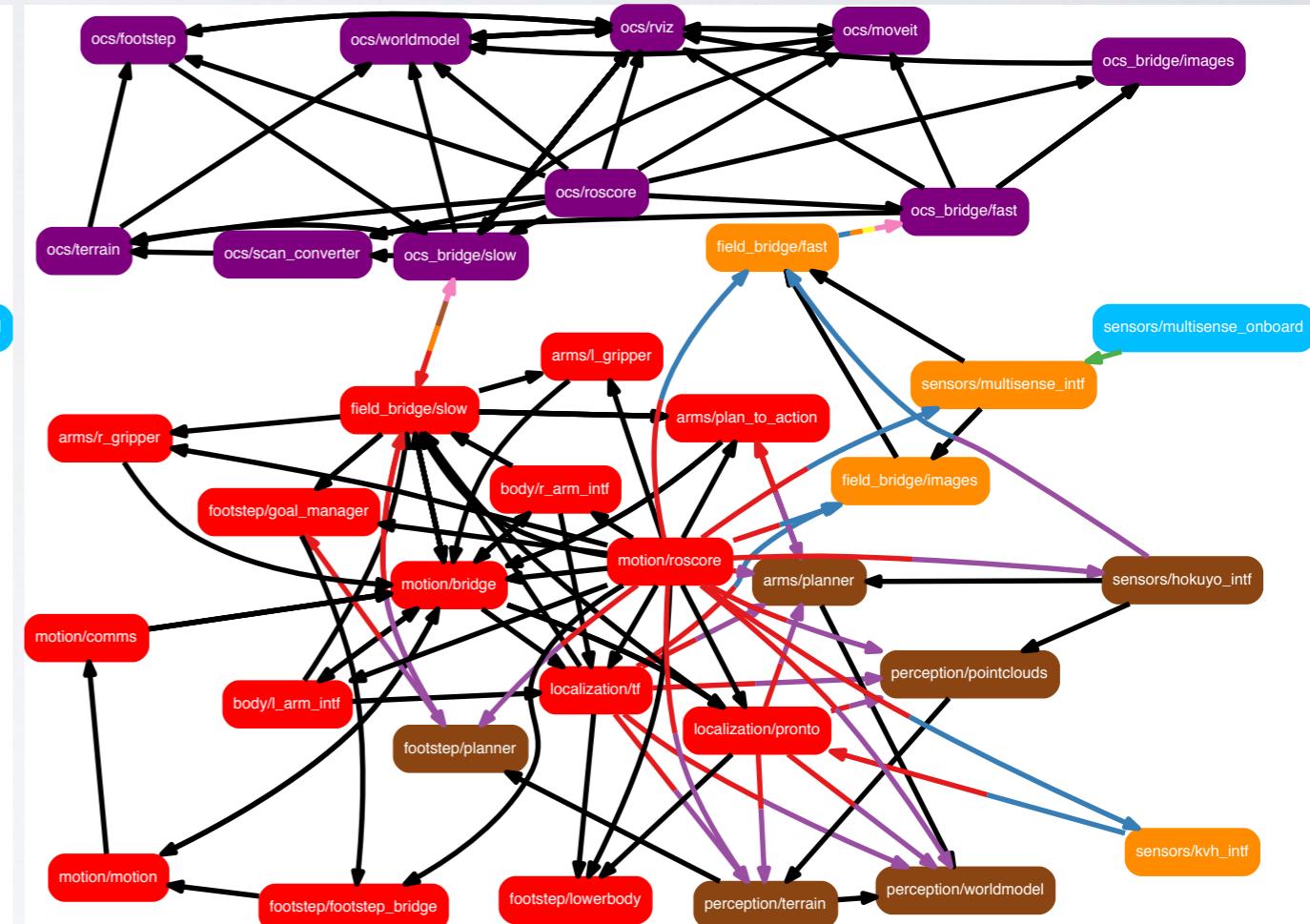


# SW STRUCTURE

Manual

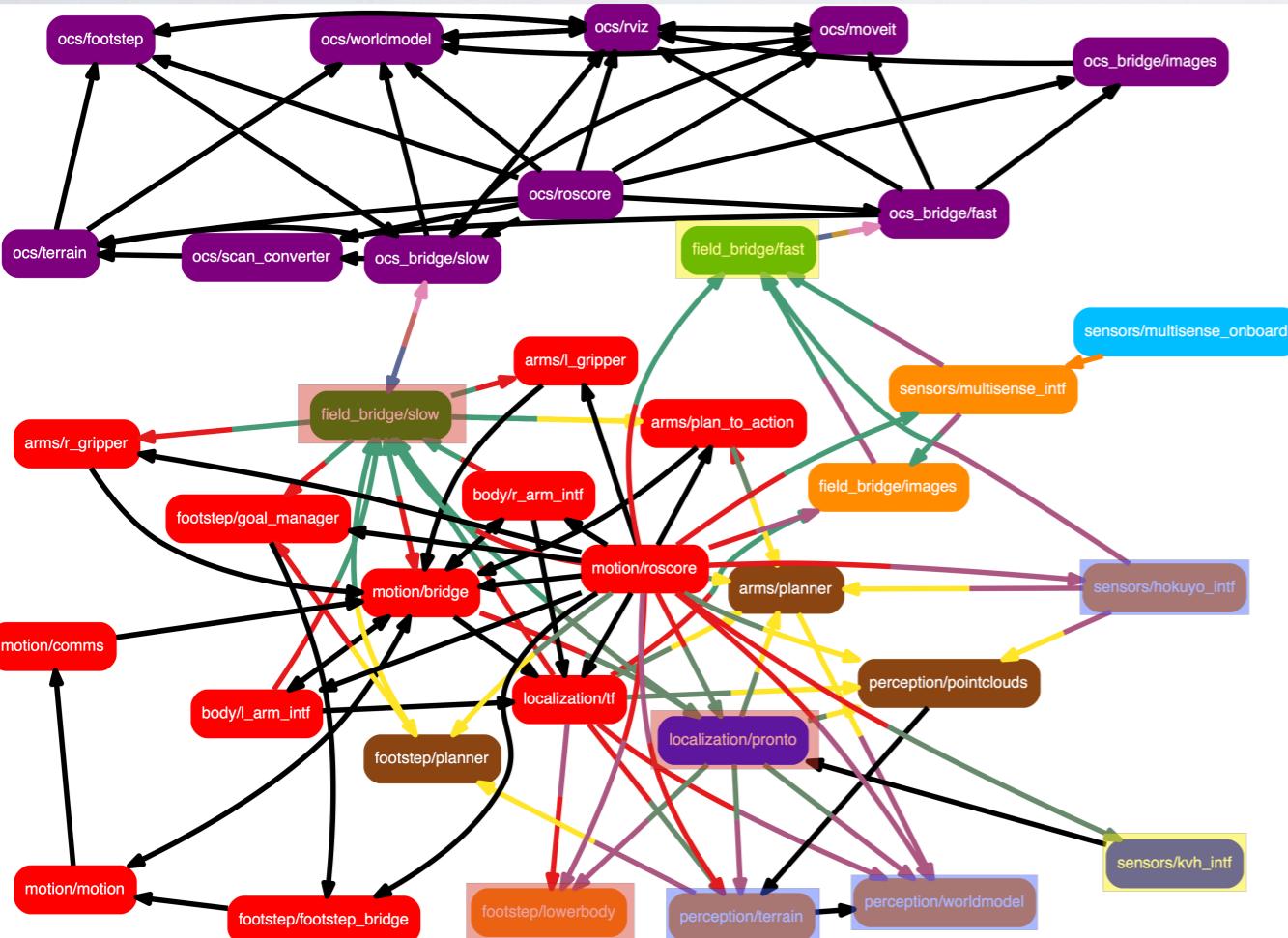


Synthesized



# SW DIFFERENCES

# Manual



# Synthesized

