Enhanced Simulation for the daVinci System

Group 6

Check Point Talk

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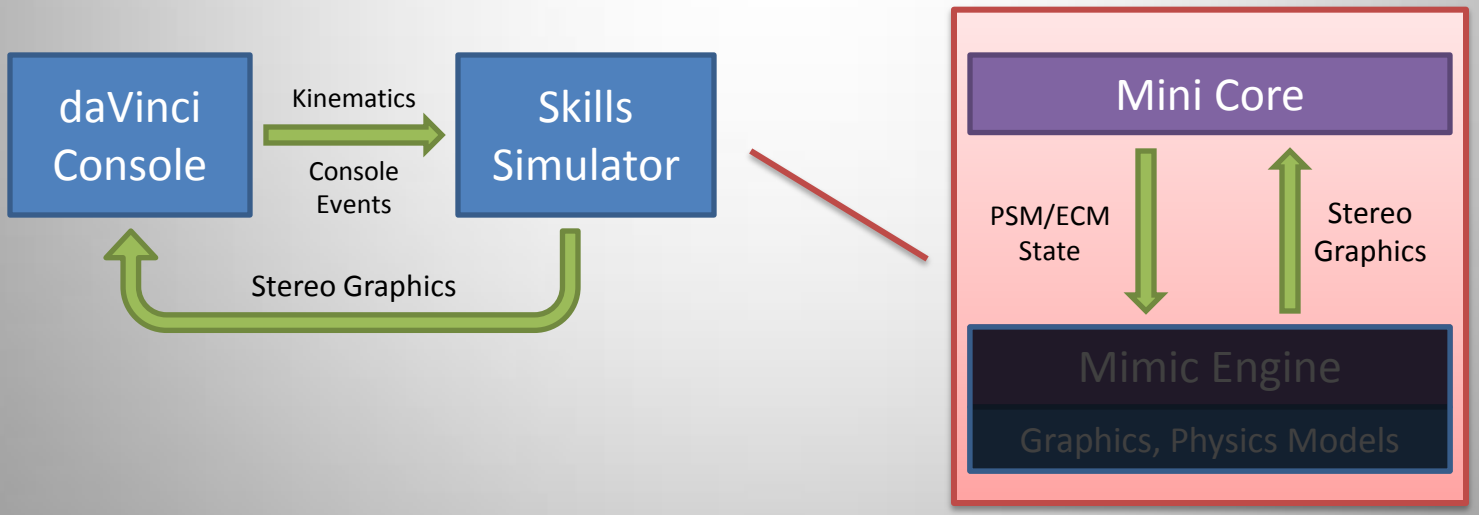
Outline

- Brief Recap
- Deliverables
- Progress
- Dependencies
- Timeline

Motivation

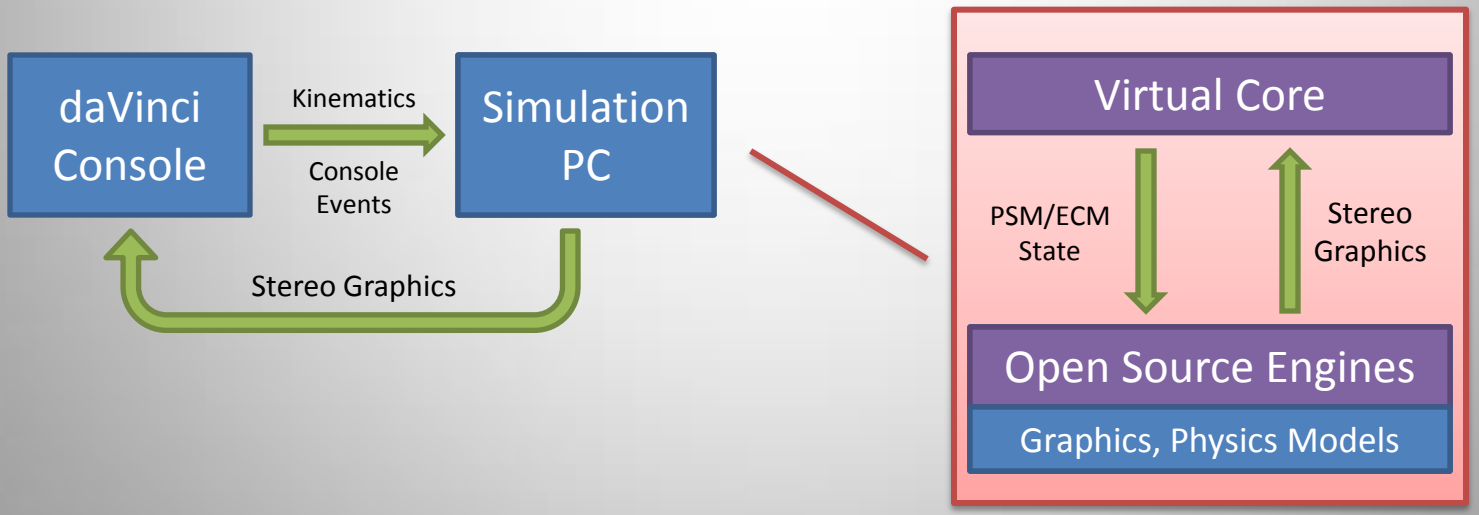
daVinci Skills Simulator [1]

Match Board Task – Mimic Simulation [2] (*Msim 2.0)*



Goal: Simulation Sandbox

- Develop a simulation framework for the daVinci System using Open Source dependencies (except ISI API [3])
  - CISST-SAW [4,5] (developed at ERC-CISST, JHU)
  - H3DAPI [6]



Deliverables

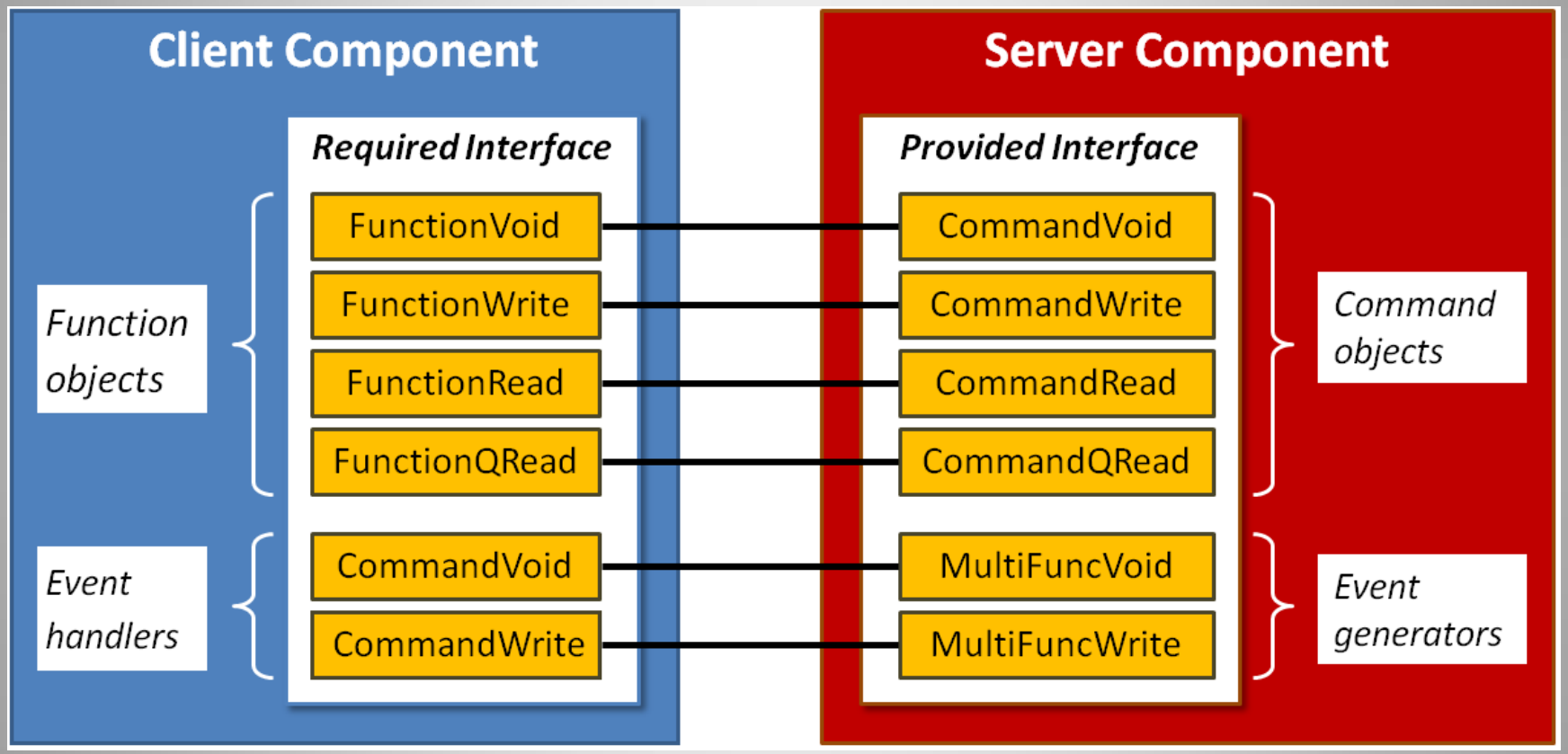
- MINIMUM [1 WEEK BEHIND]
  - Extend CISST component for BB-API [DONE]
  - Implement 'virtual slaves' component for simulation [IN PROGRESS]
  - Demo *sandbox* using a basic example
- EXPECTED
  - Extend sandbox for camera control, clutching [IN PROGRESS]
  - Demo using an application like *Match Board* task
- MAXIMUM [WILL NOT BE MET]
  - ~~Extend *sandbox* by developing new models~~
  - ~~Demo an application using these models~~

Simulation Sandbox Framework

- Software dependencies:
  - daVinci Research Interface (ISI-BBAPI) [3]
    - Communication to and from the robot
  - CISST libraries and SAW framework [4,5]
    - Computer assisted interventions
  - H3D library (includes H3DPhysics Toolkit) [6]
    - Graphics and Physics rendering

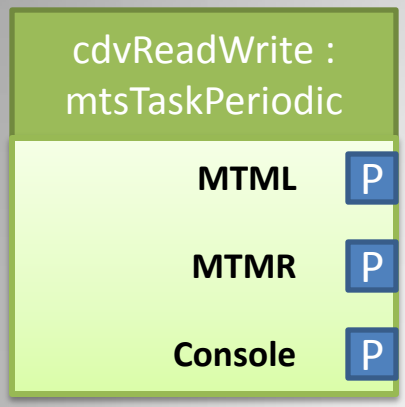
Note: project delayed due to compilation of packages on a common IDE (x64 Visual Studio 2008)

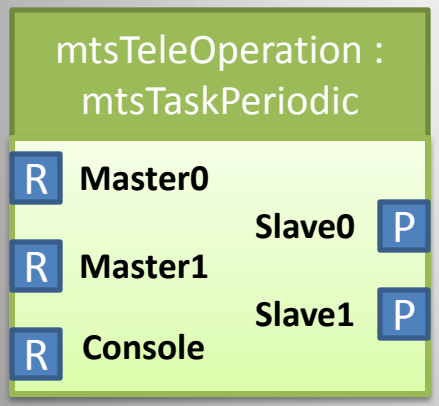
cisstMultiTask: Components[7]



cisstMultiTask Component – Interfaces [7]

CISST-SAW Components





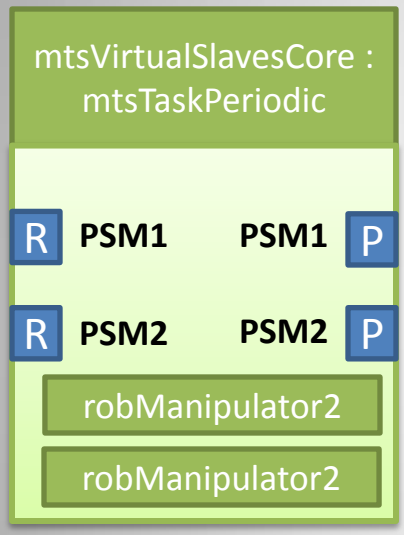
cdvReadWrite [EXTENDED]

- Wrapper for the isi-bbapi
- Added methods to disengage slaves from masters
- Provides interfaces to send Master and Console information

mtsTeleOperation [DEVELOPED]

- Component to talk to a master(s) and a slave(s)
- State Management based on console events
- Requires interfaces to receive information from Master(s)
- Provides interfaces to send information to slaves

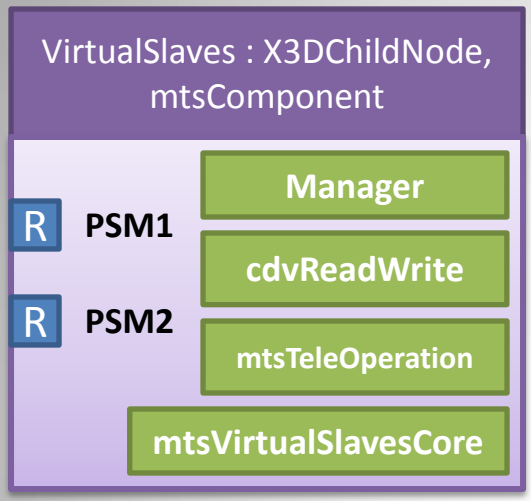
CISST-SAW Components (cont'd)



mtsVirtualSlavesCore [DEVELOPED]

- Emulates the slave side core
- Requires interfaces to receive slave cartesian positions
- Provides interfaces to send slaves joint positions
- Uses cisstRobot to perform inverse kinematics

H3D Custom Nodes



VirtualSlaves [DEVELOPED]

- H3D Node as well as CISST component
- Requires interfaces to receive slave joint positions
- Creates the CISST Component Manager as well as other components needed

SevenDOF

PIDCollection

JointPID

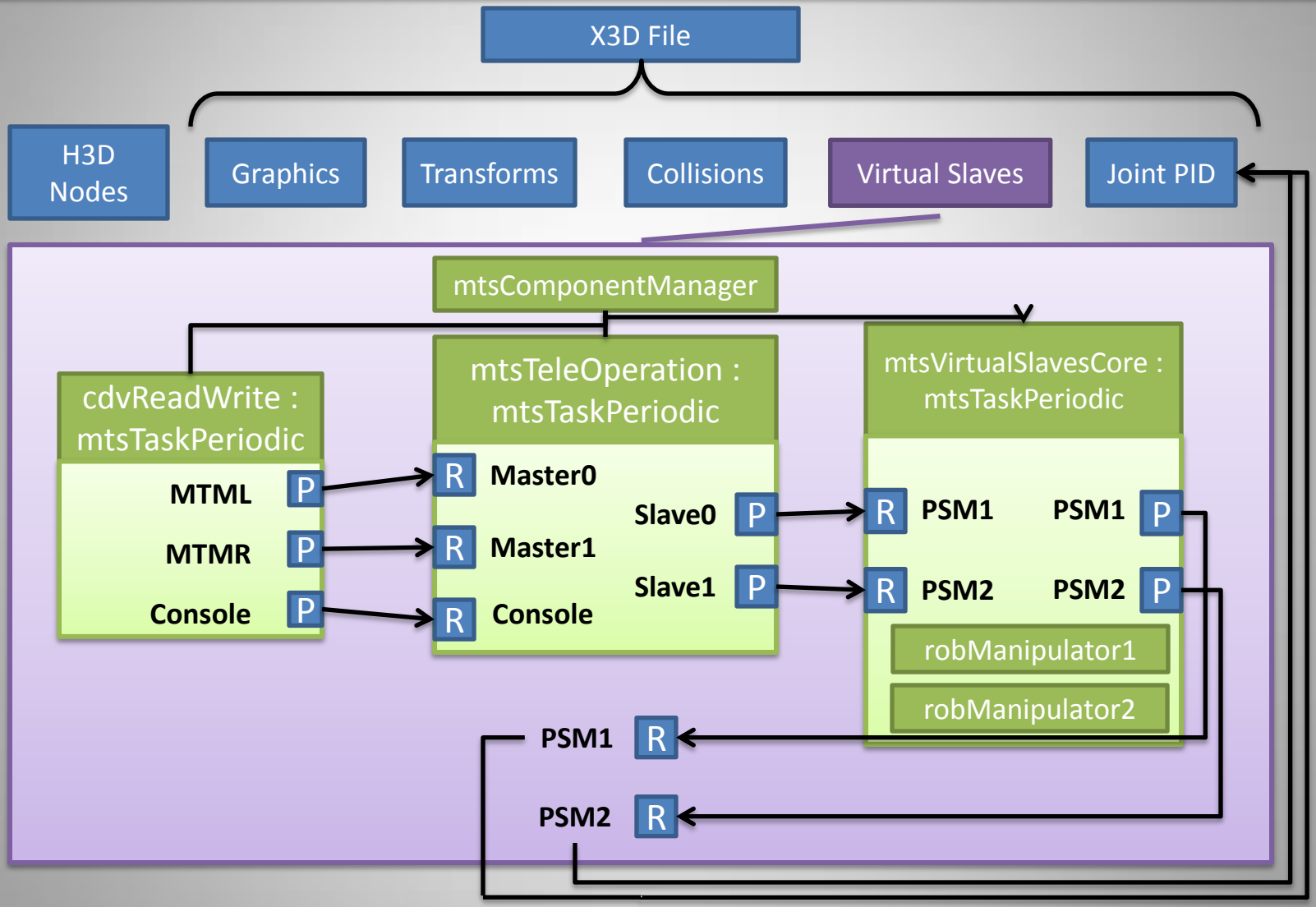
PrismaticJointPID

RevoluteJointPID

ISI Nodes [EXISTING]

- Written by Ashwin
- Performing PID Control of joints
- Datastructures for joints

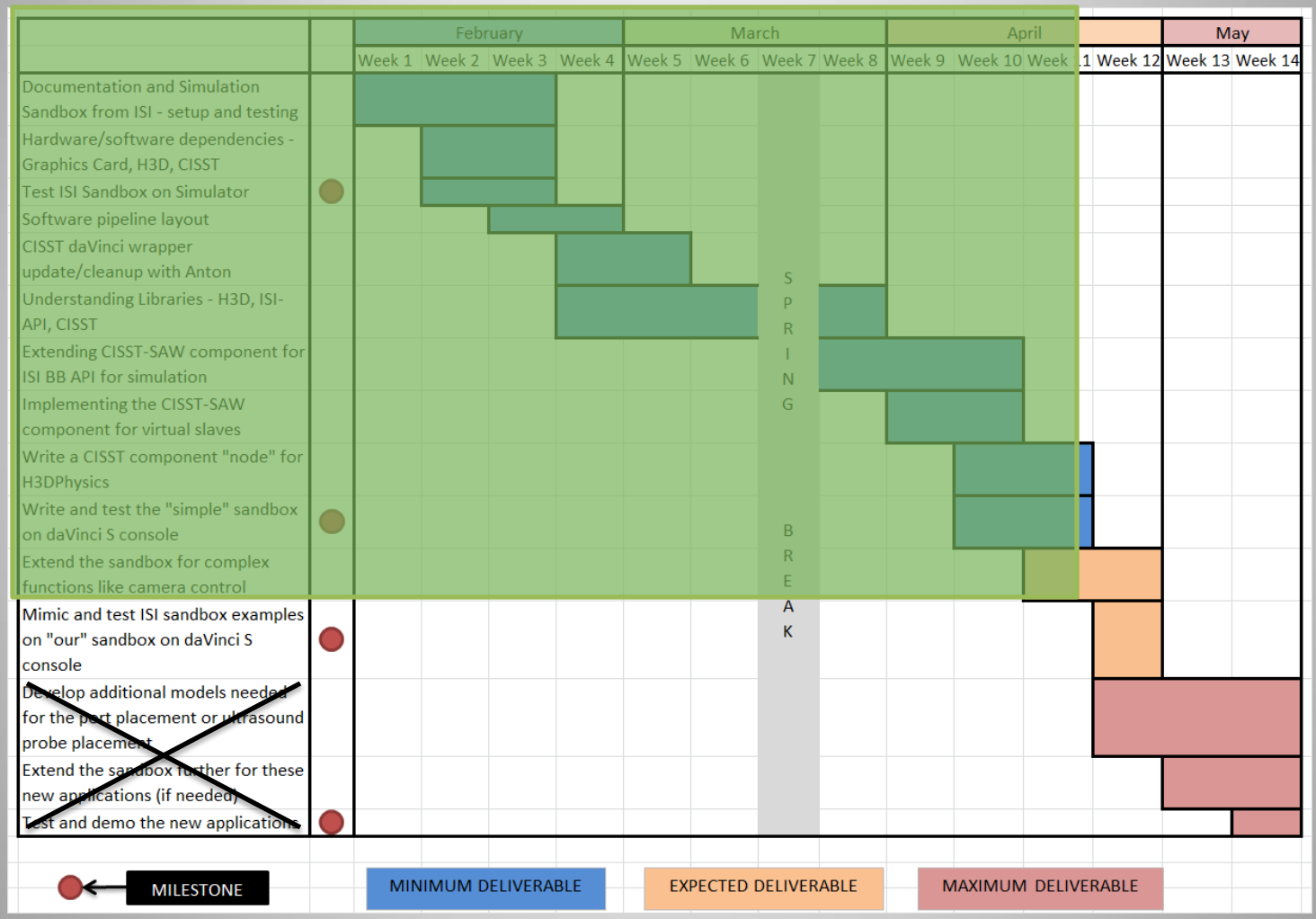
Information Flow



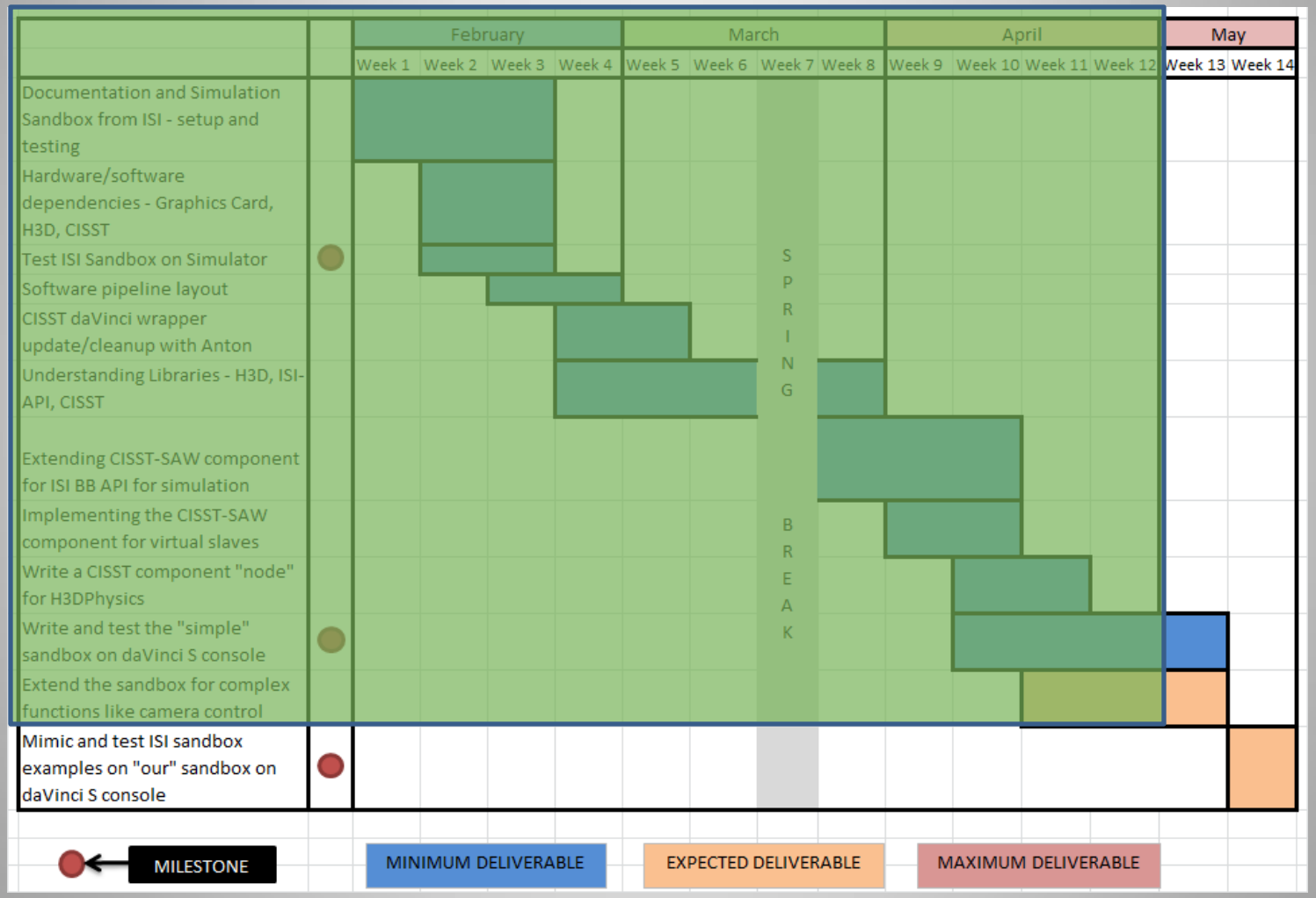
Dependencies

Dependency	Resource	Alternative	Impact
daVinci Skills Simulator assess	Other projects usage	None	Not much
Devel. Drive for Simulator	Anton	None	Not much
Existing Sandbox from ISI	Ashwin, Simon	None	Slow down!
Funds for using the daVinci S	Prof. Taylor	None	Need this!
Computer for simulation	ISI (info), Prof. Taylor (approval)	None	Need this!
ISI-BB-API assess	Anton	None	Need this!
H3D library svn assess	Network Security	Use network outside Hopkins	Not much, except bug fixes
Test hardware pipeline	New GPU	Other GPU	Project output depends on it
CISST BB-API component	Anton	Do myself	For robot communication
ISI_SIM_API documentation	Simon	Talk to Prof. Taylor	Not much
cisstRobot: inverse kinematics	Simon Leonard (bug fix!)	Use alternative or implement	Important for rendering
~~3D Model creation in X3D~~	~~Ashwin~~	~~Do myself~~	~~Maximum deliverables~~

Proposed Timeline



Modified Timeline



References, Reading

1. Intuitive Surgical Inc., *daVinci Skills Simulator User Manual*
2. Mimic Simulation, http://www.mimicsimulation.com/
3. S. DiMaio and C. Hasser, *The daVinci Research Interface*, MICCAI Workshop on Systems and Architectures for Computer Assisted Interventions, Sep. 2008
4. A. Deguet and R. Kumar and R. Taylor and P. Kazanzides, *The cisst libraries for computer assisted intervention systems*, MICCAI Workshop on Systems and Architectures for Computer Assisted Interventions, Sep. 2008
5. B. Vagvolgyi and S. DiMaio and A. Deguet and P. Kazanzides and R. Kumar and C. Hasser and R. Taylor, *The Surgical Assistant Workstation*, MICCAI Workshop on Systems and Architectures for Computer Assisted Interventions, Sep. 2008
6. Sense Graphics A B, Open Source Haptics – H3D.org
7. ERC-CISST, https://trac.lcsr.jhu.edu/cisst/wiki/cisstMultiTaskTutorial