



Collection Planning With STK

How MissionWorx™ Uses STK to Build Collection Plans

Joe Pemberton & Flavius Galiber – Veridian Systems

May 2003



Overview



- What is Collection Planning?
- How does MissionWorx™ do Collection Planning?
- Where does STK come in?
- How does MissionWorx™ use STK?
- Examples
- Summary

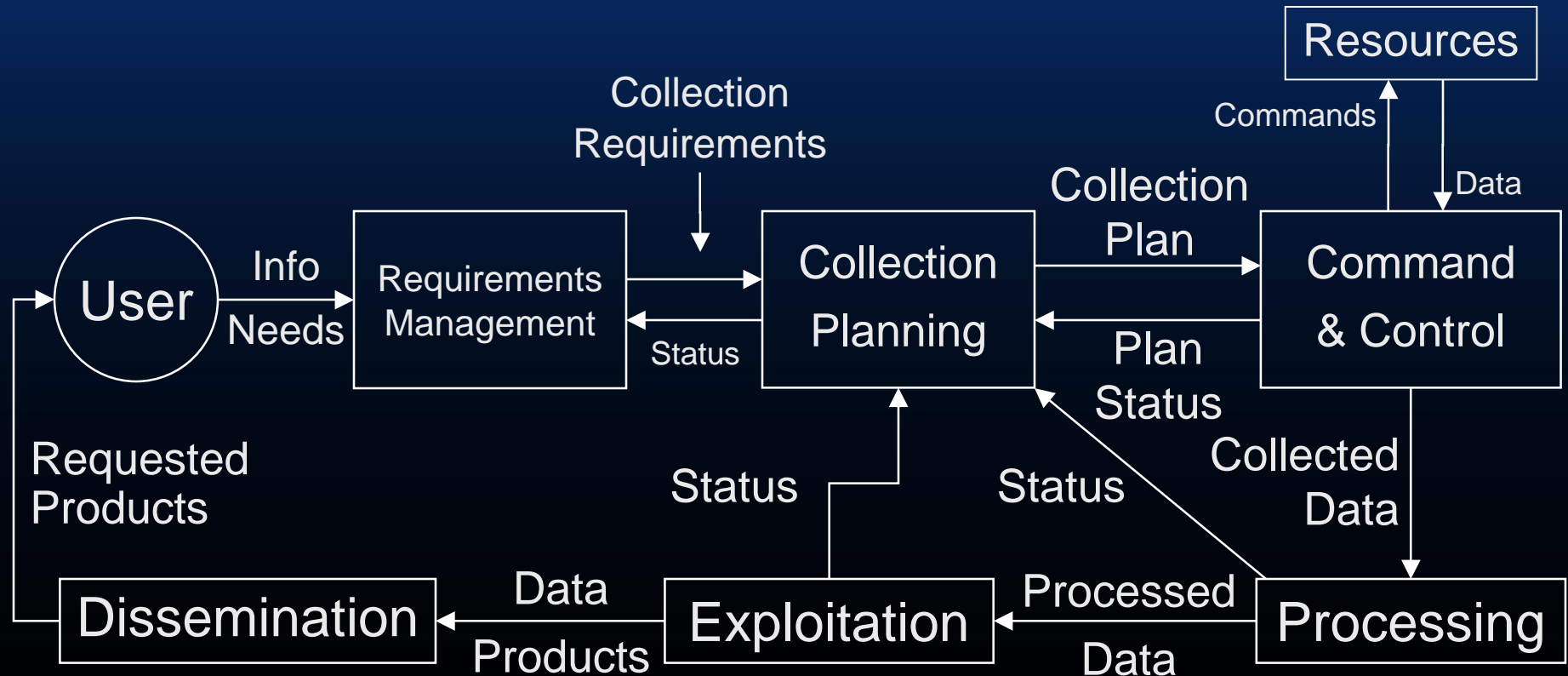


What Is Collection Planning?

- Collection Plan =
set of (collection requirements, resources, execution times)



Collection Planning: Big Picture



Steps of Collection Planning

- Given a set of resources and user requirements
 - Identify resources that can satisfy each requirement
 - Create activities necessary to satisfy each requirement
 - Determine times that each activity can be performed
 - Determine best combination of time and resource selection for each activity subject to:
 - Constraints on activities
 - Constraints on resources
 - User objectives
 - Evaluate overall collection plan value

MissionWorx™ Approach



- MissionWorx™ uses a constraint-based approach to generating optimized collection plans
 - Collection planning problems are modeled as:
 - Tasks
 - Collection tasks, downlink tasks, processing tasks
 - Resources
 - Airborne sensors, space-borne sensors, antennae, processing equipment
 - Constraints
 - Collection visibility, downlink visibility, real-time collection and downlink, communications bandwidth, processing throughput limitations, due dates
 - Preferences
 - Collection quality, preferred resources
 - Optimization objective:
 - Find best possible mapping of tasks to resource time slots subject to constraints and user preferences



MissionWorx™ Planning Process



- Setup the planning task:
 - Determine which resources can perform each collection activity?
 - Can the sensor satisfy the collection requirements?
 - Does the sensor have access to the collection target?
 - Can the downlink be performed?
 - Can the data be processed once it has been downlinked?
- Generate an optimized schedule
 - While time permits
 - For each activity, choose resources and execution time
 - Calculate collection plan value and compare to the best plan so far
 - Return best schedule found



Where Does STK Come In?



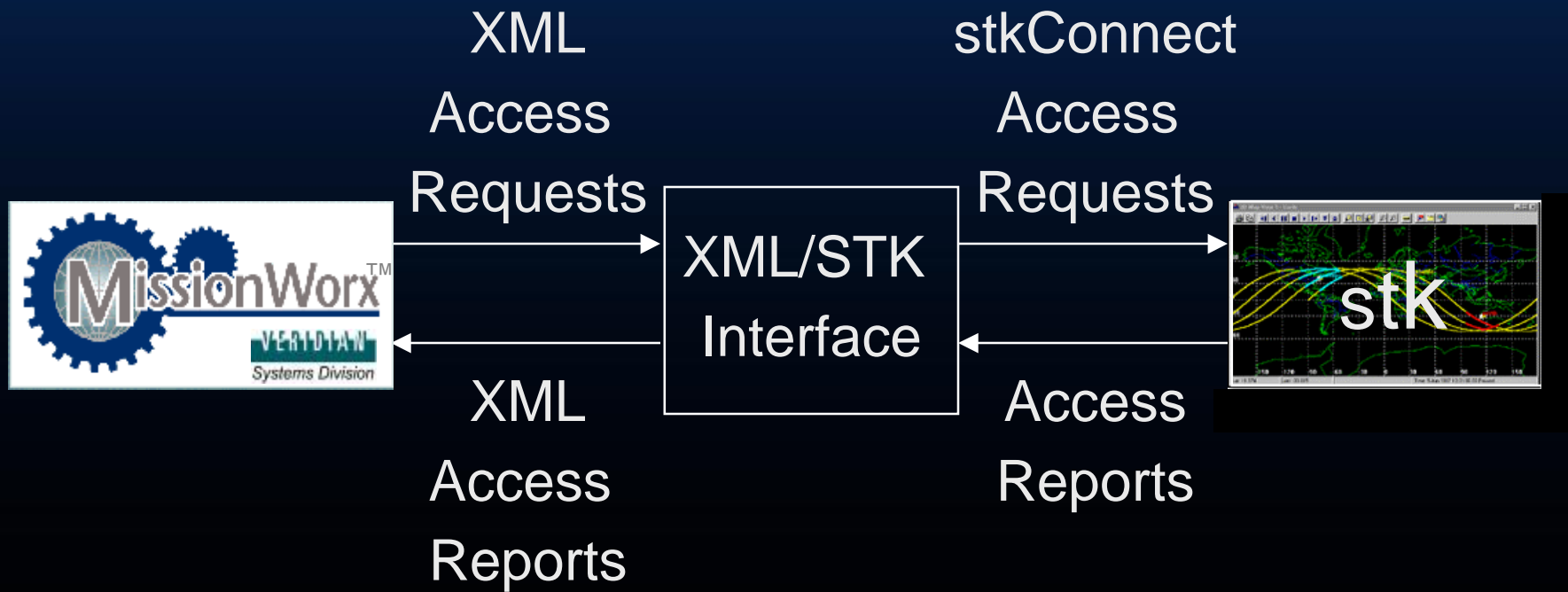
- STK helps MissionWorx™ determine:
 - When an air- or space-borne sensor can collect a target
 - Sensor must be able to see the target
 - Collection constraints (e.g., collection quality) must be satisfied
 - When an air- or space-borne platform can downlink collected data to a ground terminal?
 - Platform must be able to see the ground terminal
- STK also helps visualize the collection plan



How MissionWorx™ Uses STK



Access Calculation:



Example Access Request

- XML access request:
 <UPDATE_VISIBILITIES />
- Connect translation:
 ChainGetStrands / Scenario/*/Chain/*

Example Access Report



- Connect access report:

Returning ' Facility/Osan/Sensor/Osan-Downlink To Satellite/RADARSAT-1/Sensor/SAR-Antenna

To Target/Z1031947630026target /Application/STK/Scenario/IMINT/Chain/TargetViz 4

03 Jul 2003 09:39:09.85 03 Jul 2003 09:42:55.31 03 Jul 2003 21:52:08.55

03 Jul 2003 21:56:48.09 04 Jul 2003 09:07:05.73 04 Jul 2003 09:11:58.31

04 Jul 2003 21:22:05.54 04 Jul 2003 21:24:14.50'

- XML translation:

```
<VISIBILITY VEHICLE="RADARSAT-1" GROUNDSTATION="Osan" PAYLOAD="SAR-Antenna" TARGET="Z1031947630026target" GSANTENNA="Osan-Downlink">
```

```
<WINDOW START="03-Jul-2003 09:39:09" STOP="03-Jul-2003 09:42:55" />
```

```
<WINDOW START="03-Jul-2003 21:52:08" STOP="03-Jul-2003 21:56:48" />
```

```
<WINDOW START="04-Jul-2003 09:07:05" STOP="04-Jul-2003 09:11:58" />
```

```
<WINDOW START="04-Jul-2003 21:22:05" STOP="04-Jul-2003 21:24:14" />
```

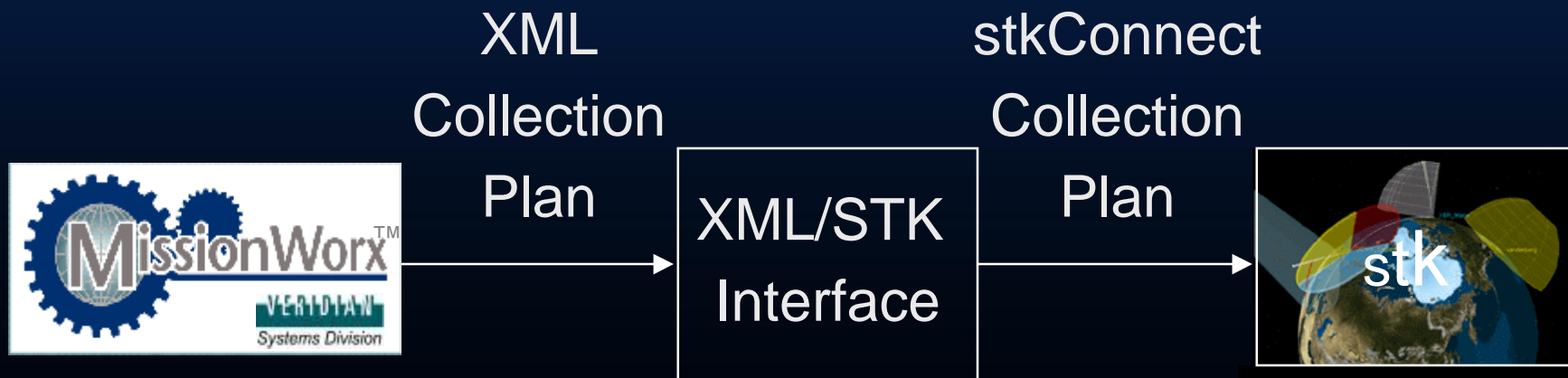
```
</VISIBILITY>
```



How MissionWorx™ Uses STK



Mission Visualization:



Example Visualization Output



- XML collection plan:

```
<ACTIVITY NAME="S1042755546207collect"  
  TYPE="collect" REQID="S1042755546207" VEHICLE="LANDSAT_07"  
  PAYLOAD="ETM" MODE="PAN"  
  GROUNDSTATION="GS1"  
  GSANTENNA="GS1-Downlink"  
  VEHANTENNA="LANDSAT_07-Downlink"  
  START="02-Jun-2003 18:16:49"  
  STOP="02-Jun-2003 18:16:59" LOCKED="N"/>
```

- Connect translation:

```
DisplayTimes Scenario/*/Satellite/LANDSAT_07/Sensor/ETM Intervals  
Replace 20 "02 Jun 2003 18:16:49.00" "02 Jun 2003 18:16:59.00"
```



Summary

- MissionWorx™ uses STK to:
 - Determine when and how collection tasks can be performed
 - Determine when downlink tasks can be performed
 - Visualize resulting collection plan
- The result is an optimized collection plan that the user can visualize

