



Flight Software Effects on Ground Systems

JAXA's Approach: Standardization of Flight Software

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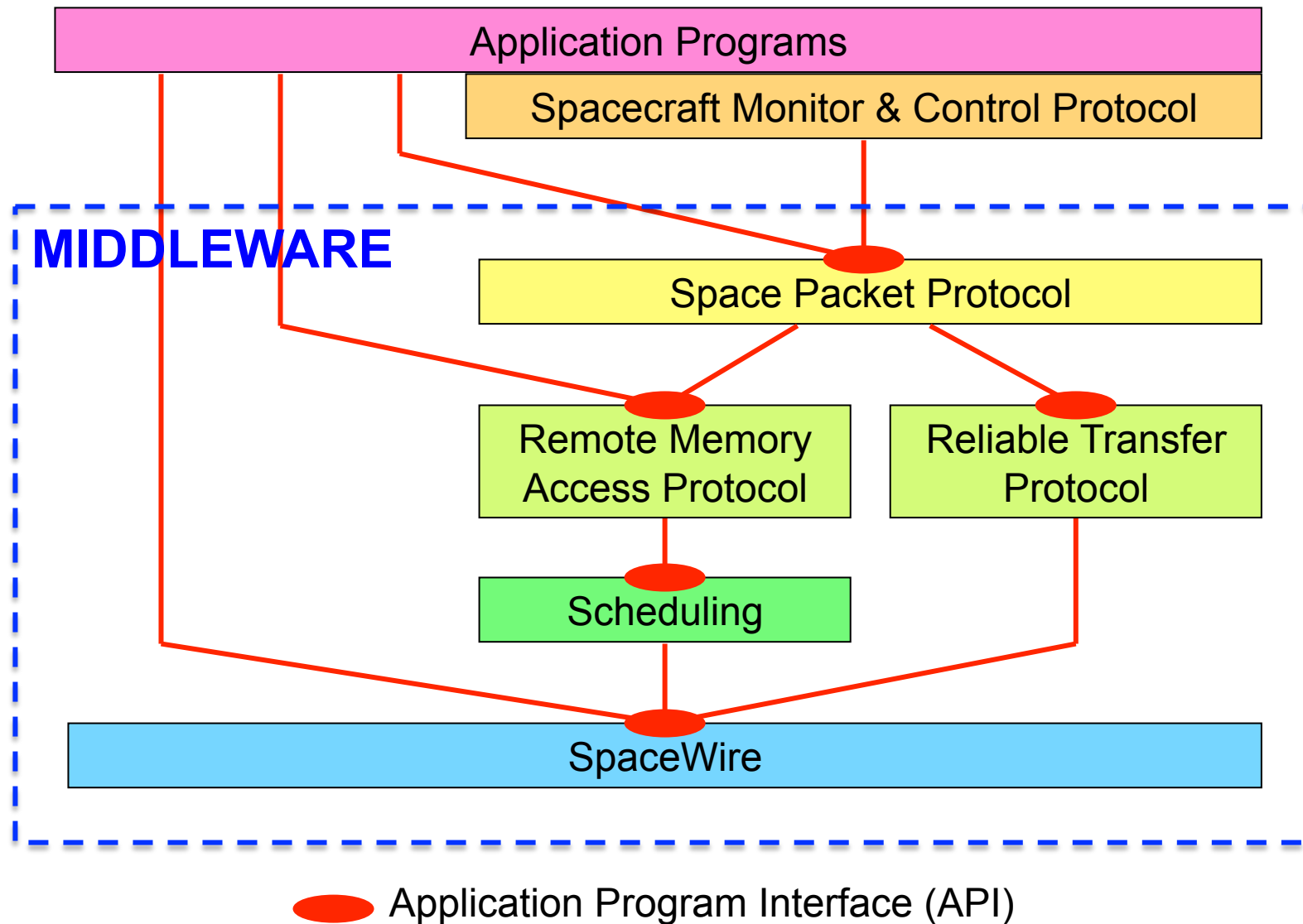


JAXA's Approach

- ◆ JAXA is using a new approach to develop flight software.
- ◆ In the past, each piece of flight software was designed, tested and operated almost independently without using any standard or guideline. This prevented reuse of flight software and sharing of ground systems for testing and operations.
- ◆ In order to promote reuse of flight software and sharing of ground systems, JAXA has developed a framework for standardization of flight software.
- ◆ In this framework, a layer of standard protocols is defined.
- ◆ Each protocol is implemented as middleware (software or a combination of hardware and software) with a standard application program interface (API), which can be used by any application program or upper layer protocol.
- ◆ The development of application programs can be done almost independently of the design of the underlying protocols.



Layered Protocol Architecture





Examples

- ◆ On some of the spacecraft that we are developing right now, the same middleware is used on:
 - Central Data Handling Processor
 - Attitude and Orbit Control Processor
 - Mission Data Processor
- ◆ The differences between the flight software on these processors are only
 - Application programs, and
 - Options and parameters of the underlying protocols implemented as middleware.

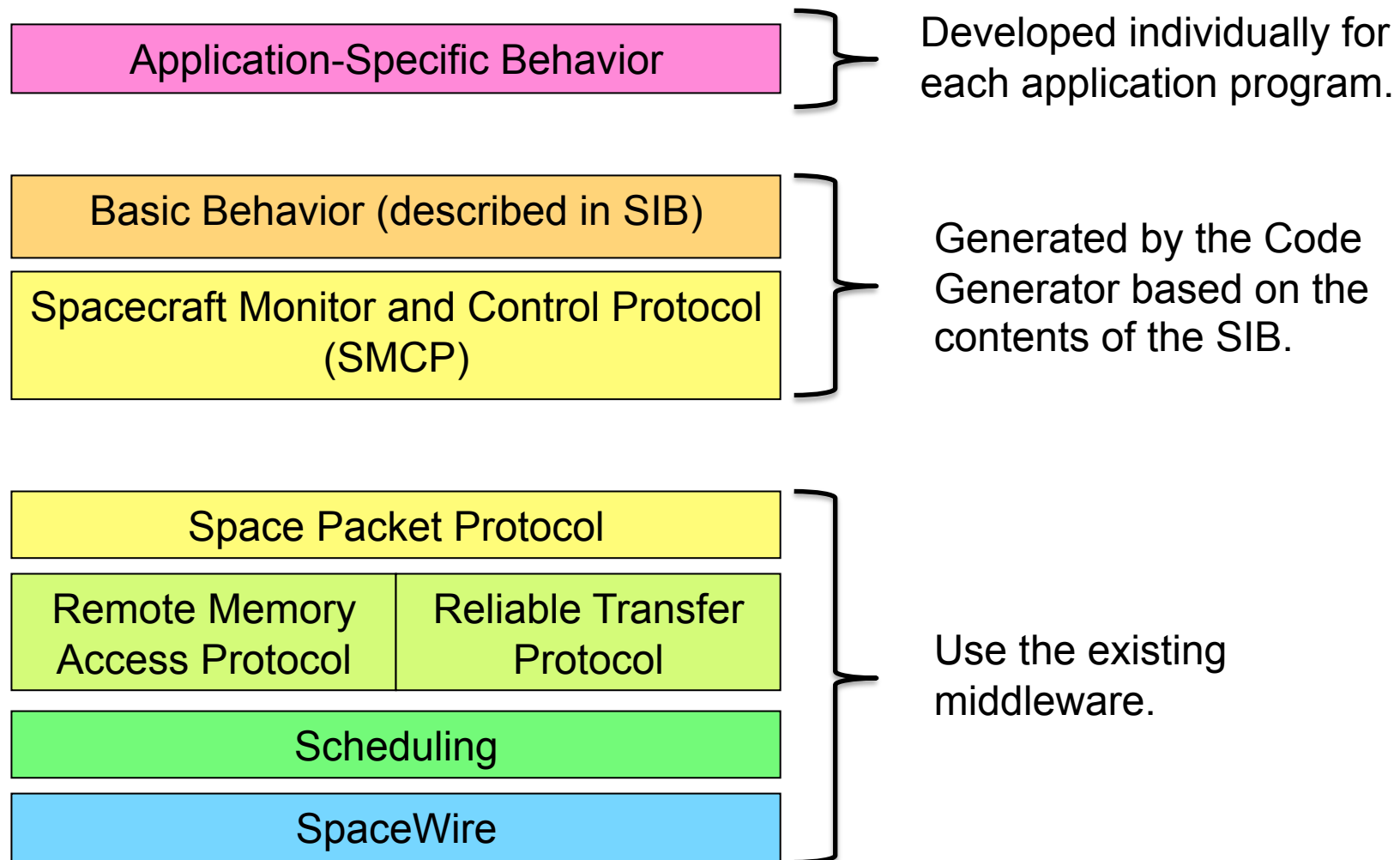


Spacecraft Functional Model

- ◆ We have one more standard associated with flight software, which is called the Functional Model of Spacecraft (FMS).
- ◆ FMS specifies a set of rules to describe the behavior of the applications programs.
- ◆ The description of each application program generated based on FMS can be stored in a standard database called the Spacecraft Information Base (SIB).
- ◆ The SIB can be populated with a tool based on Microsoft Excel. The data entered with this tool is converted into an XML document automatically.
- ◆ The contents of SIB can be used by any application program (mostly on the ground), for example:
 - Spacecraft monitor and control software (existing)
 - Flight code generator (existing)
 - Spacecraft simulator (future plan)

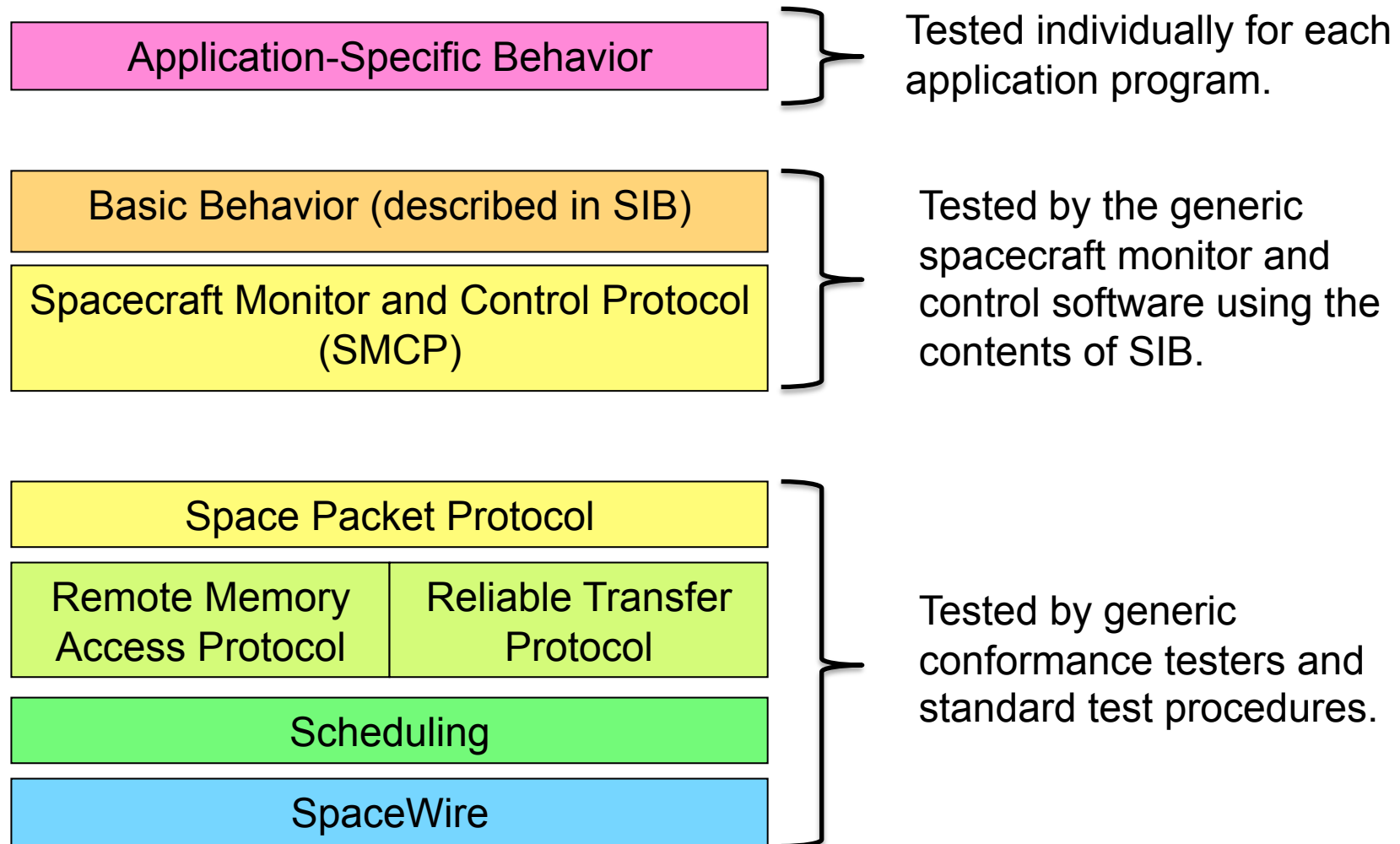


How We Develop Flight Software





How We Test Flight Software





How We Operate Flight Software

