

ANALYSIS OF CCSDS SOIS SERVICES

Takahiro Yamada (JAXA/ISAS)

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Purpose of This Presentation

- ❖ This presentation presents a preliminary result of an analysis of the CCSDS SOIS services performed by JAXA.
- ❖ The goal of the analysis is to determine whether each of the SOIS services is applicable to the onboard data system infrastructure that is being developed by JAXA for Mercury Magnetospheric Orbiter (MMO) of the BepiColombo project and JAXA's spacecraft after MMO.
- ❖ This presentation has two parts:
 1. Onboard Data System Infrastructure of JAXA
 2. Applicability of SOIS Services to the Onboard Data System Infrastructure

Part 1

Onboard Data System Infrastructure

of JAXA

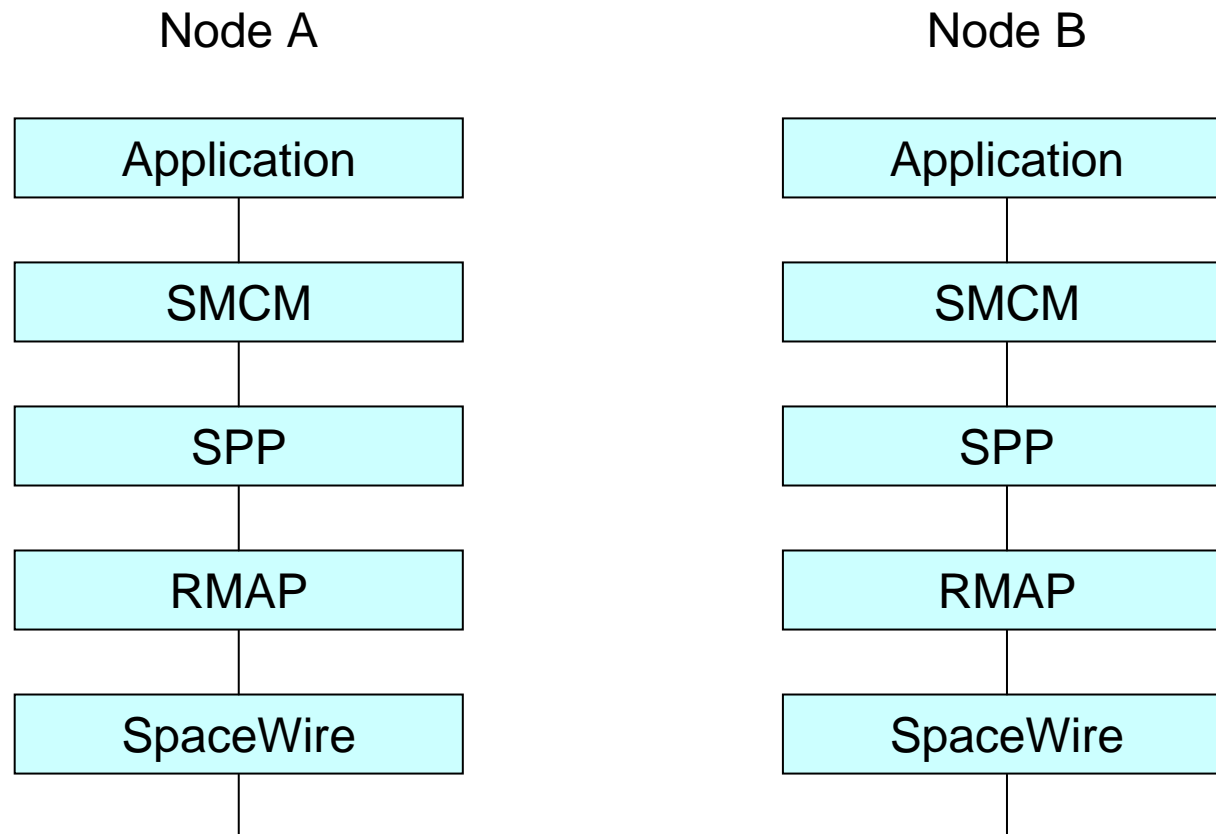
Onboard Data System Infrastructure of JAXA

- ❖ JAXA is developing an onboard data system infrastructure that can be used by many types of onboard instruments of future spacecraft of JAXA.
- ❖ The infrastructure consists of the following hardware elements:
 - Standard CPU box (SpaceCube2) with SpaceWire interfaces
 - Standard I/O boards and ADC/DAC boards that connect instruments to the SpaceWire network
- ❖ The infrastructure supports the following standard protocols:
 - SpaceWire
 - Remote Memory Access Protocol (RMAP)/SpaceWire
 - CCSDS Space Packet Protocol (SPP)
 - Spacecraft Monitor and Control Messages (SMCM, JAXA standard)

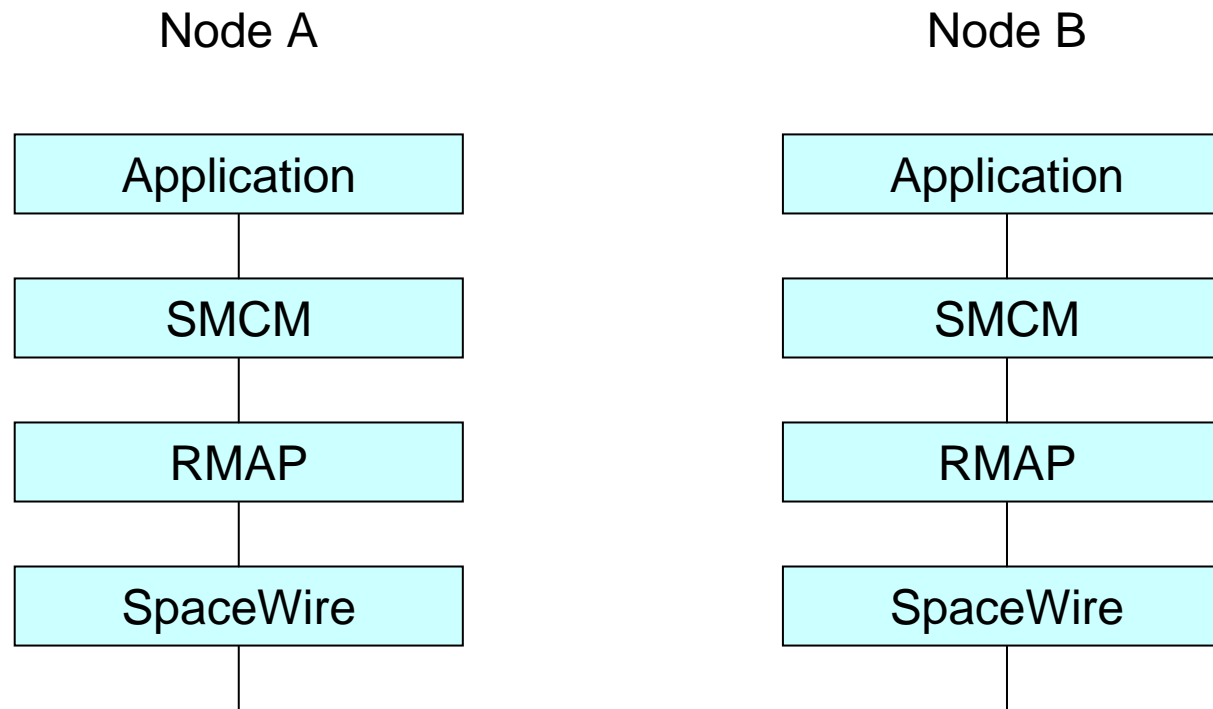
Protocol Configuration Principles

- ❖ SpaceWire is always used as the standard Data Link protocol.
- ❖ RMAP is always used to standardize the interface between the SpaceWire network and the instruments.
- ❖ In configurations where a network protocol is required, the Space Packet Protocol is used as the standard network protocol.
- ❖ In configurations where a network protocol is not required, the Space Packet Protocol is bypassed.
- ❖ For intelligent instruments, the 'Spacecraft Monitor and Control Messages (SMCM)' standard is used as the standard application protocol. This standard may not be used for transferring science data.
- ❖ For non-intelligent instruments, RMAP, together with a mechanism for managing memory addresses, is used to monitor and control instruments.

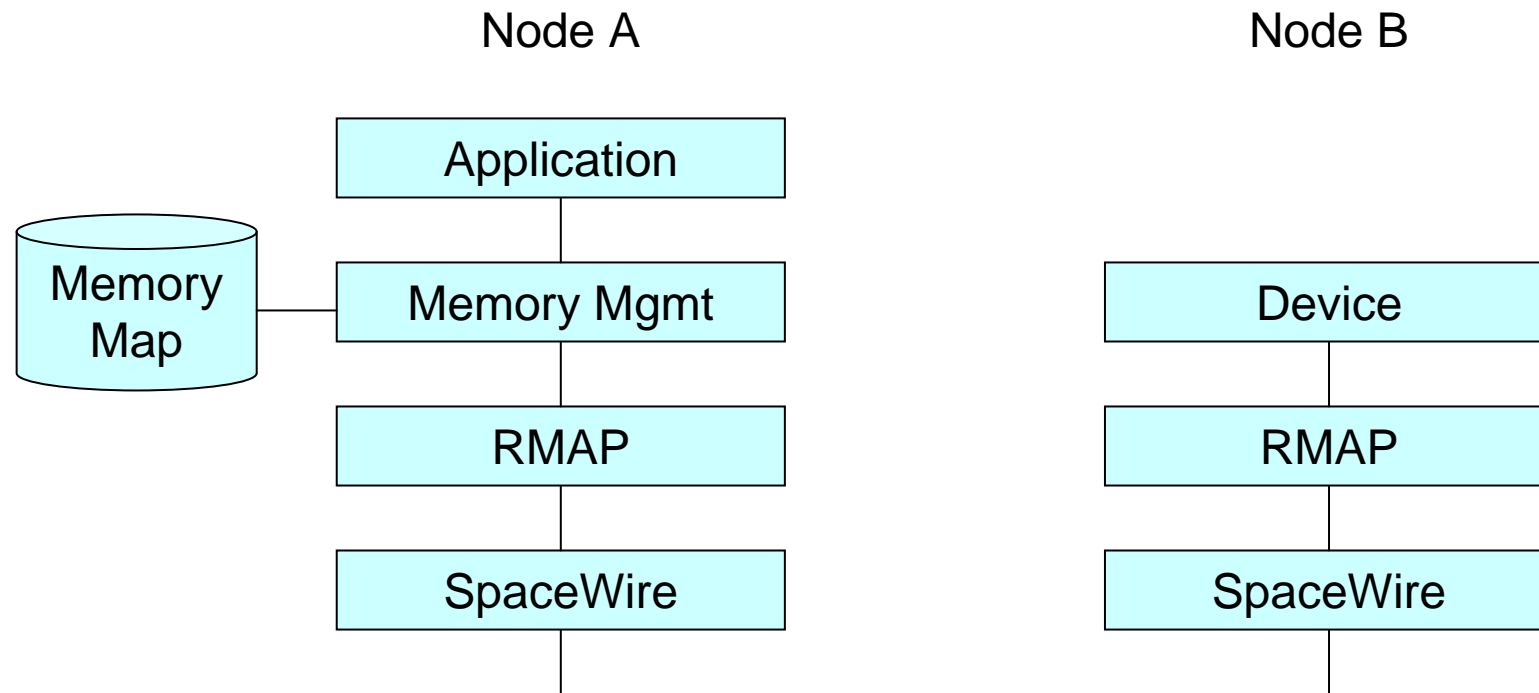
Typical Protocol Configuration 1



Typical Protocol Configuration 2



Typical Protocol Configuration 3



Part 2

Applicability of SOLS Services to the Onboard Data System Infrastructure

SOIS Services

- ❖ We reviewed the SOIS Green and Red Books available on the CCSDS web site in order to determine whether they are applicable to the onboard data system infrastructure we are developing, which is based on SpaceWire.
- ❖ The SOIS books define onboard services in a clear and consistent way and provide a good framework for considering what higher layer services and protocols are to be used on top of the SpaceWire protocol.
- ❖ The following slides show (1) whether each of the SOIS services is applicable to our onboard data system infrastructure and, if it is applicable, (2) where in the protocol stacks we showed it will be used.

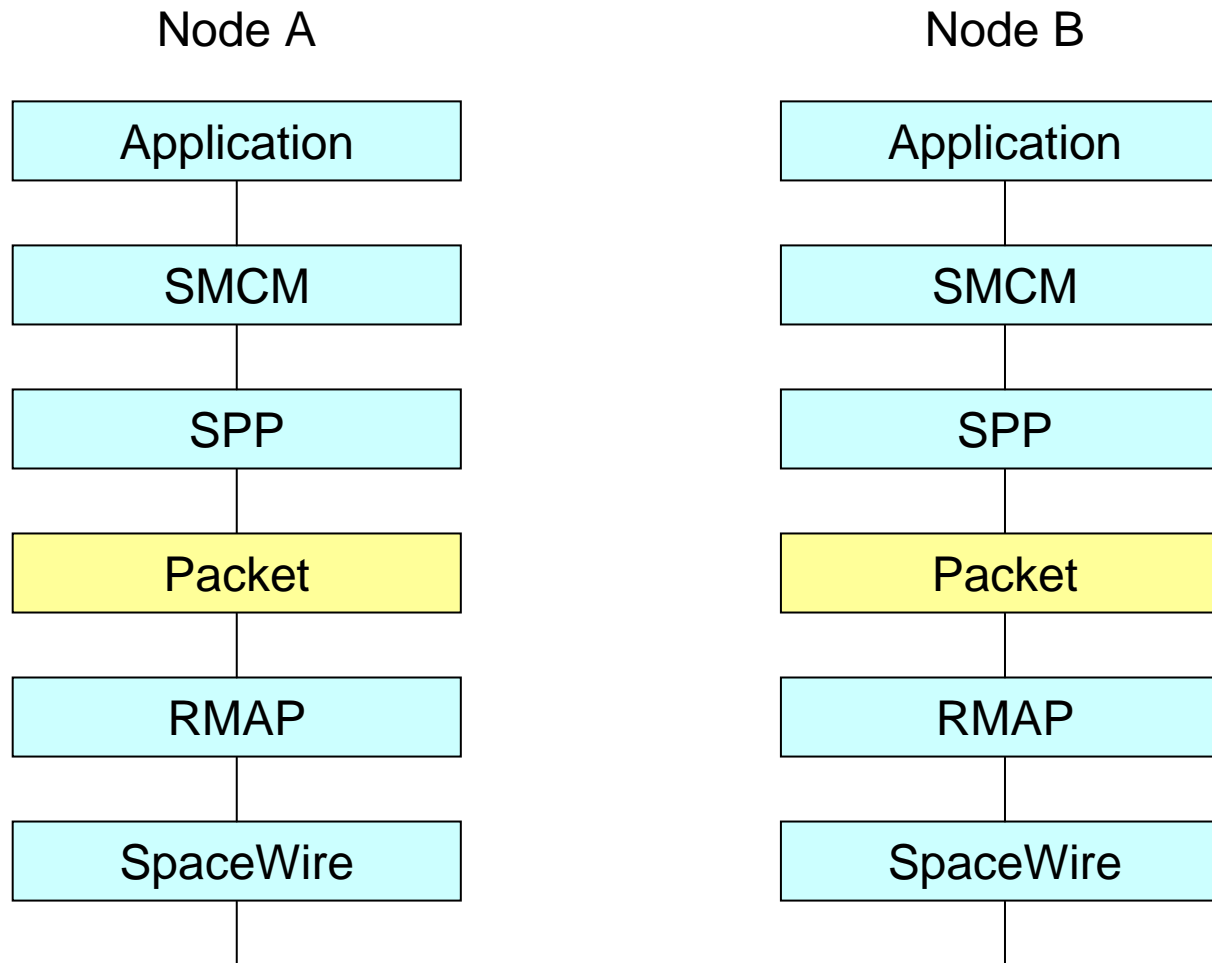
Applicability of SOIS Subnet Layer Services

Service	Applicability	Comment
Packet	High ❖ Will need a protocol that runs over RMAP/SpaceWire	See Slides 13 & 14
Memory Access	Medium ❖ Will need a mapping to RMAP/SpaceWire ❖ Will use it with Cmd & Data Acq. Service	See Slide 15
Time Distribution	Medium ❖ Will need a protocol that runs over RMAP/SpaceWire ❖ Will use it with Time Access Service	See Slide 16
Device Discovery	Low	
Test	Low	

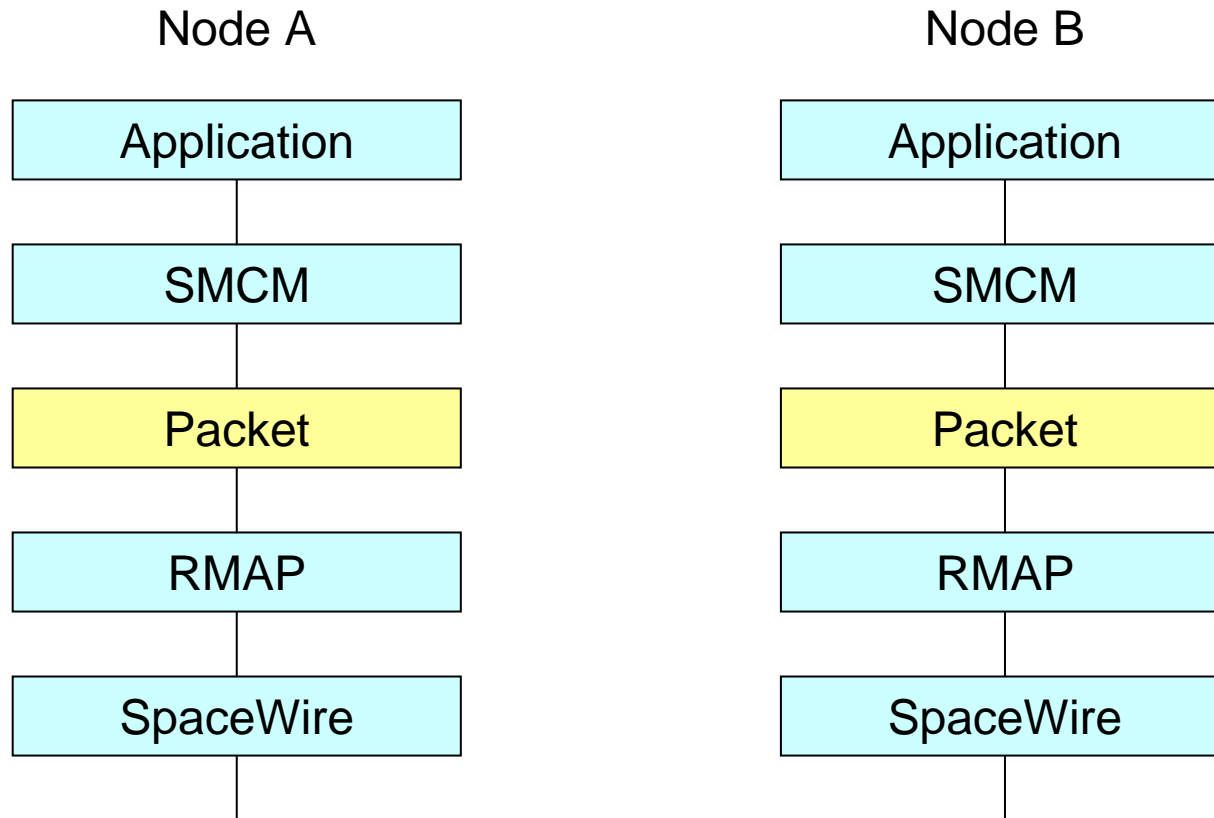
Applicability of SOIS Subnet Layer Services

Service	Applicability	Comment
Cmd/Data Acquisition	Medium ❖ Will use it with Memory Access Service	See Slide 15
Time Access	Medium ❖ Will use it with Time Distribution Service	See Slide 16
File	Low	
Message Transfer	Low	
Device Enumeration	Low	

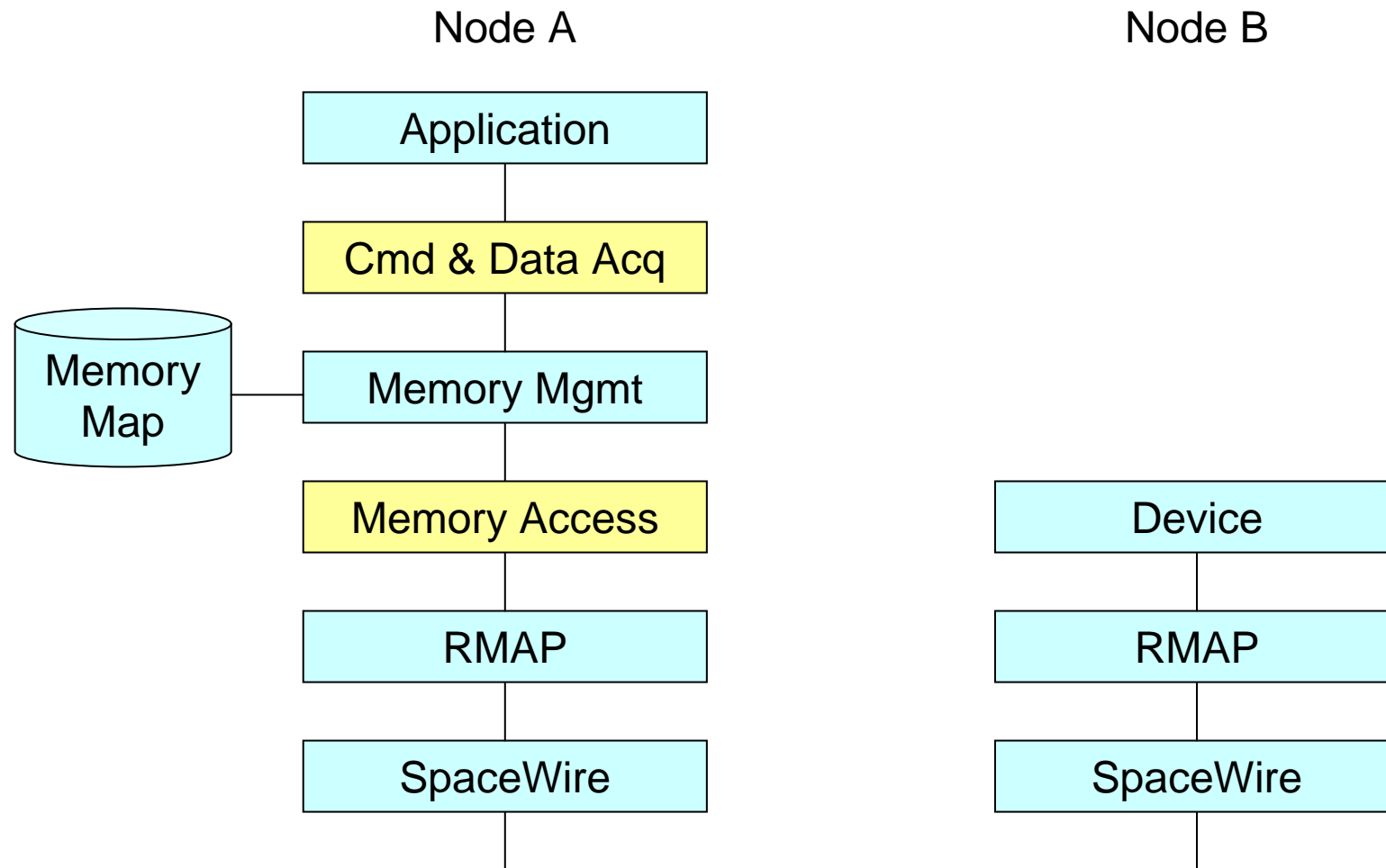
Use of Packet Service 1



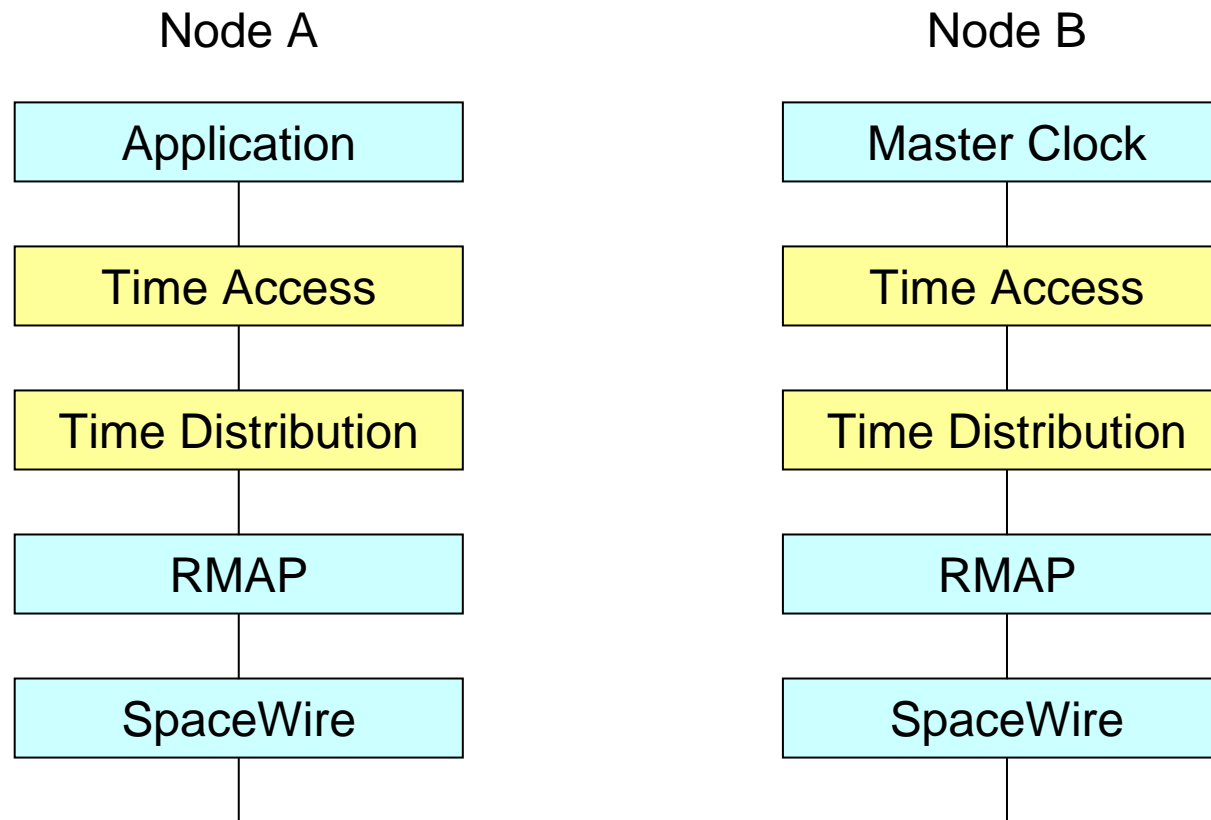
Use of Packet Service 2



Use of Command/Data Acquisition and Memory Access Services



Use of Time Access and Time Distribution Services



Conclusion

- ❖ We are interested in some of the SOIS services because they may be applicable to the onboard data system infrastructure that we are developing for our future spacecraft.
- ❖ We are in particular interested in the Packet Service and a protocol that supports this service over RMAP/SpaceWire. We will be glad to participate in the definition and development of this protocol.