SpaceWire-WG#13 TK1-09-100

Evaluation for the proto-type SpW BP and Investigation of Standard topology for SpW BP

2009.09

MELCO, Osaka University,
JAXA/ISAS

Contents

1. Introduction
2. Evaluation for the proto-type SpW BP
3. Investigation of Standard topology for SpW BP

Introduction

MELCO …Mitsubishi Electric Corporation
http://global.mitsubishielectric.com/bu/space/index.html
Business field;

Energy and Electric Systems

Information and Communication Systems

Industrial Automation Systems

Electronic Devices

Home Appliances

http://global.mitsubishielectric.com/company/overview/index.html

Introduction

http://global.mitsubishielectric.com/bu/space/overview/achievements/index.html

Introduction

MELCO, Osaka Univ. and JAXA/ISAS were started to develop the prototype of SpaceWire back plane since last year.

- Purpose
  - ➔To achieve high-speed data transfer
  - ➔Standardization of SpW topology

Items of development

FY2008 Evaluation of a prototype SpW BP

1. Selection of Connectors
2. Evaluation of Connectors
3. PCB Design, Manufacture
   - Pin assignment
   - Pattern Routing
4. Performance check

FY2009 Development of a prototype component with a SpW BP for standardization

1. Investigation for standard Topology on BP
   - SpW & SpFi
2. SpW component Design
3. Manufacture of Component
4. Performance check

Items of development

FY2008 Evaluation of a prototype SpW BP

1. Selection of Connector
2. Evaluation of Connector
3. PCB Design, Manufacture
   - Pin assignment
   - Pattern Routing
4. Performance check

The second International SpaceWire Conference

FY2009 Development of a prototype component with a SpW BP for standardization

1. Investigation for standard Topology on BP
   - SpW & SpFi
2. SpW component Design
3. Manufacture of Component
4. Performance check

Items of development

FY2008 Evaluation of a prototype SpW BP

1. Selection of Connector
2. Evaluation of Connector
3. PCB Design, Manufacture
   - Pin assignment
   - Pattern Routing
4. Performance check

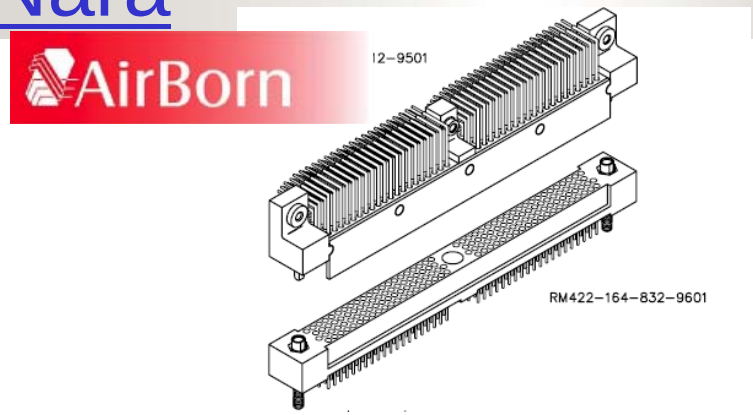
FY2009 Development of a prototype component with a SpW BP for standardization

1. Investigation for standard Topology on BP
   - SpW & SpFi
2. SpW component Design
3. Manufacture of Component
4. Performance check

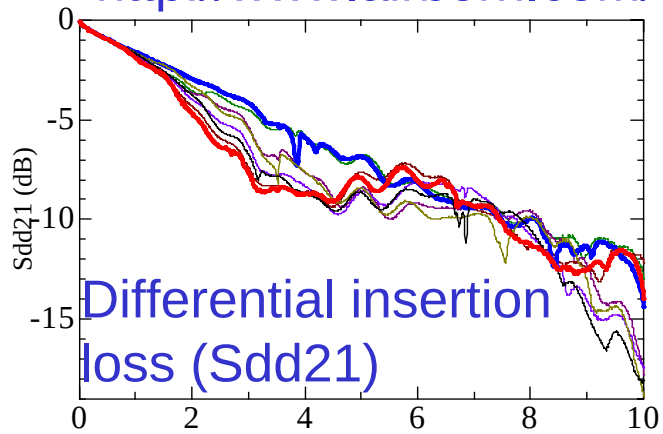
Summary of Nara

- Selection of connector
  - Pin, Module
    RM452-110-312-9500
  - Receptacle, BackPlane
    RM422-110-832-9600

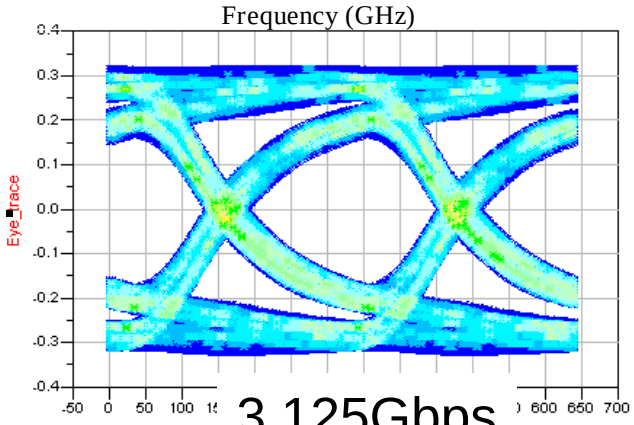
  Space Qualified, easily available,
  and not too expensive.
- Evaluation of connector
  - Insertion and return loss level
  - Cross talk level
- Guideline of pin assignment
- Simulation of BP transmission with connector model
  - Over 3Gbps transmission is possible.



http://www.airborn.com/

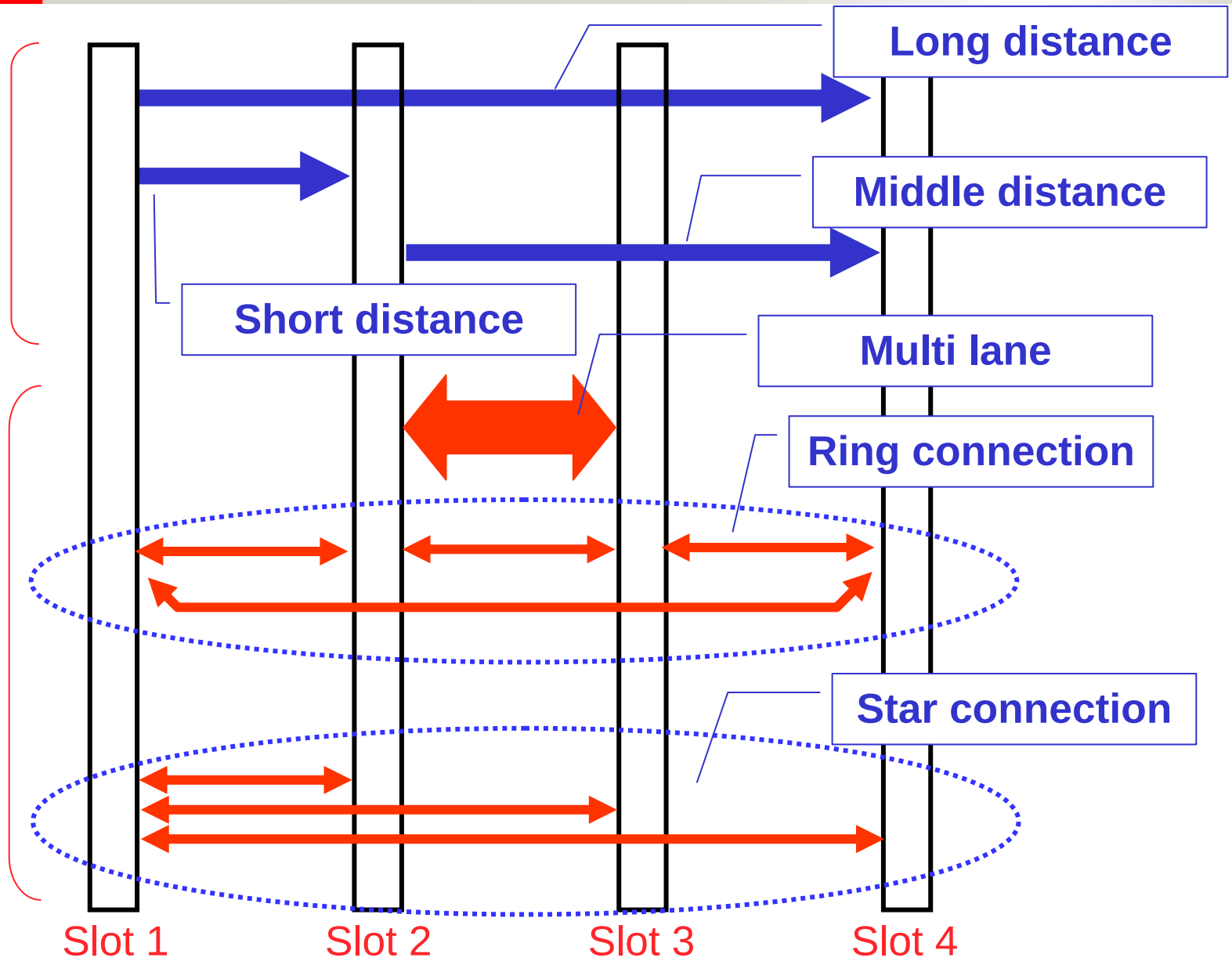


Differential insertion loss (Sdd21)



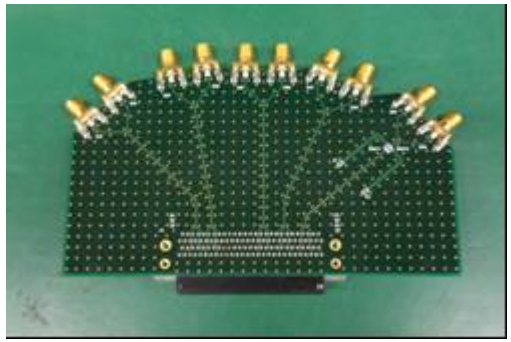
3.125Gbps

Connection of prototype BP

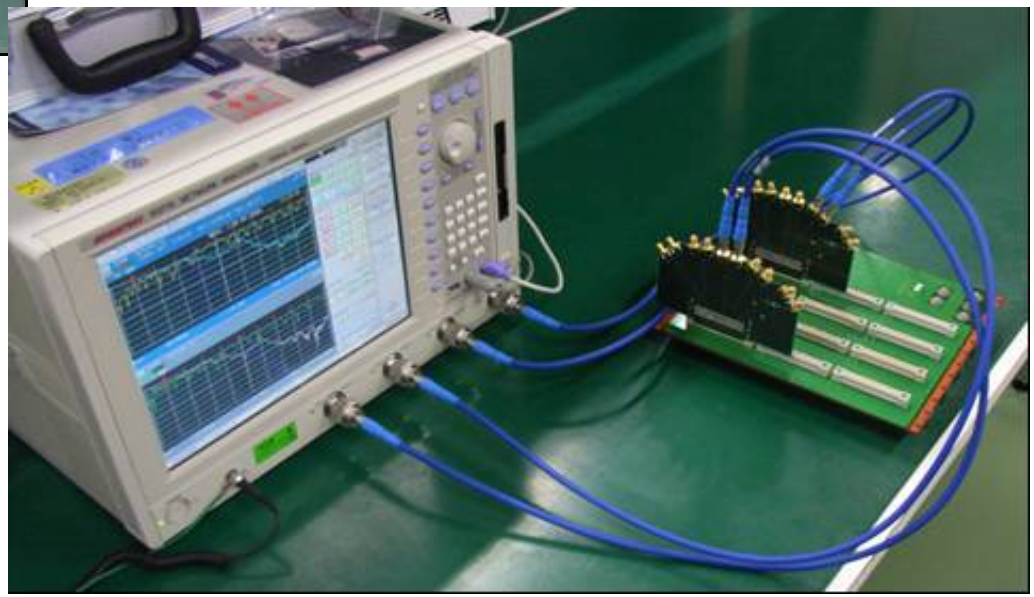


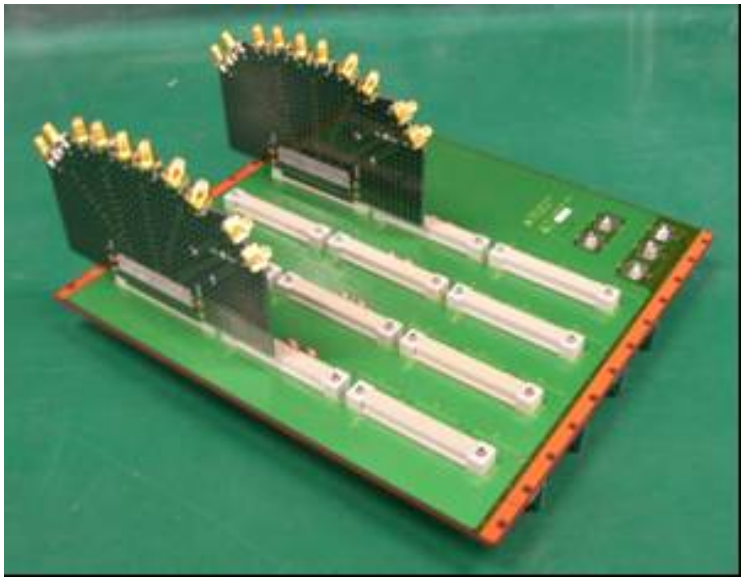
Back Plane Evaluation

Backplane

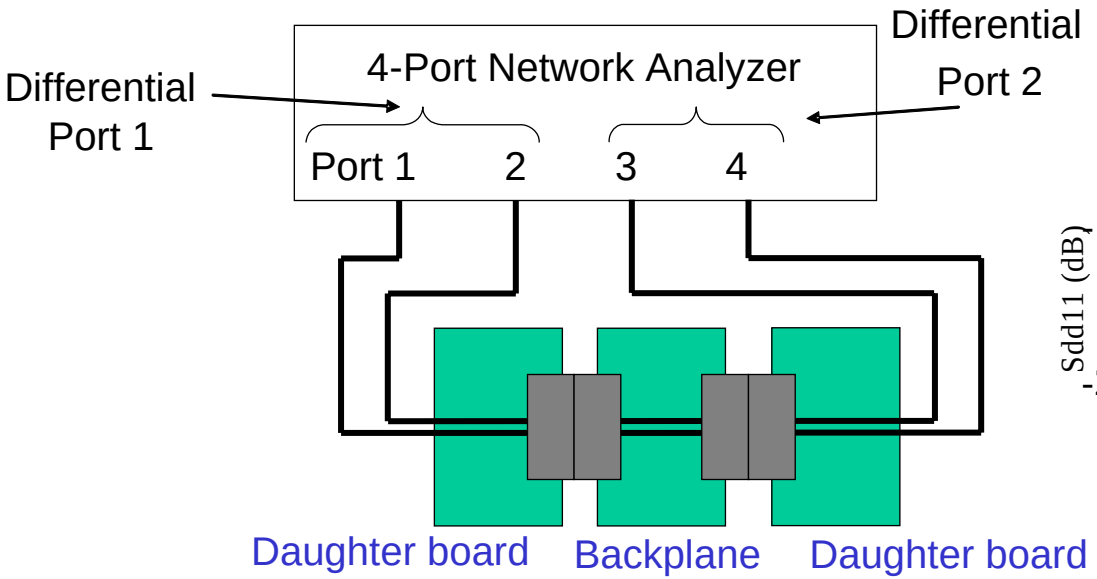


Daughter board

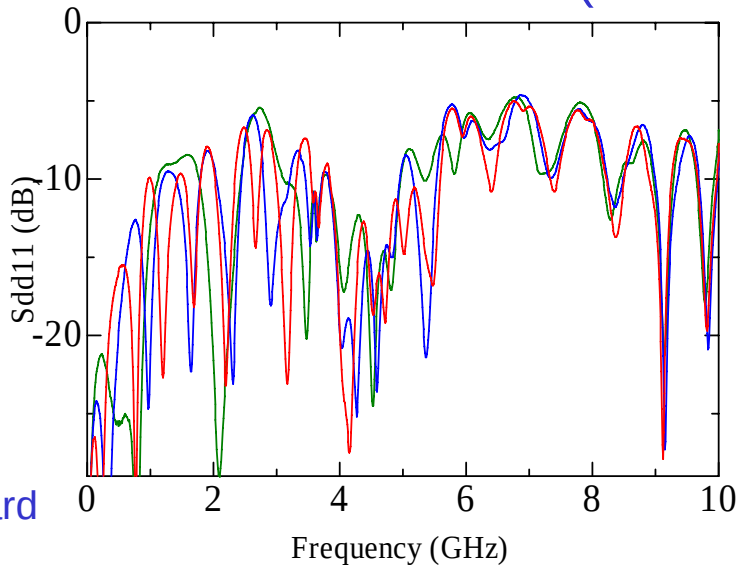




Frequency Response

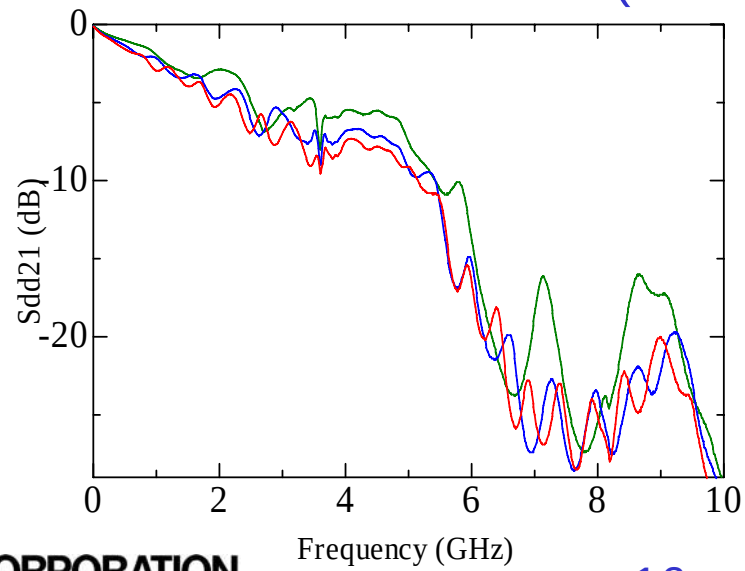


Differential return loss (Sdd11)



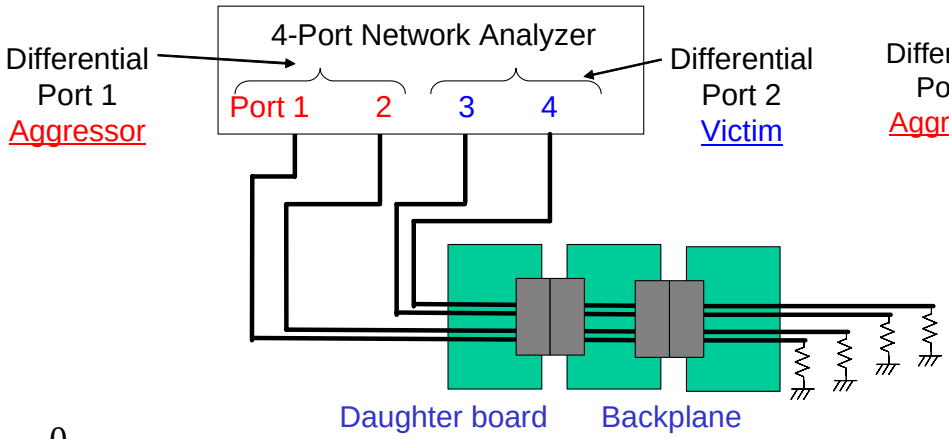
- Two figures show totally S-parameter.
  - Green Line : Short Distance
  - Blue Line : Middle Distance
  - Red Line : Long Distance
- It has little sensitivity with distance.
- The connector deteriorate signal level

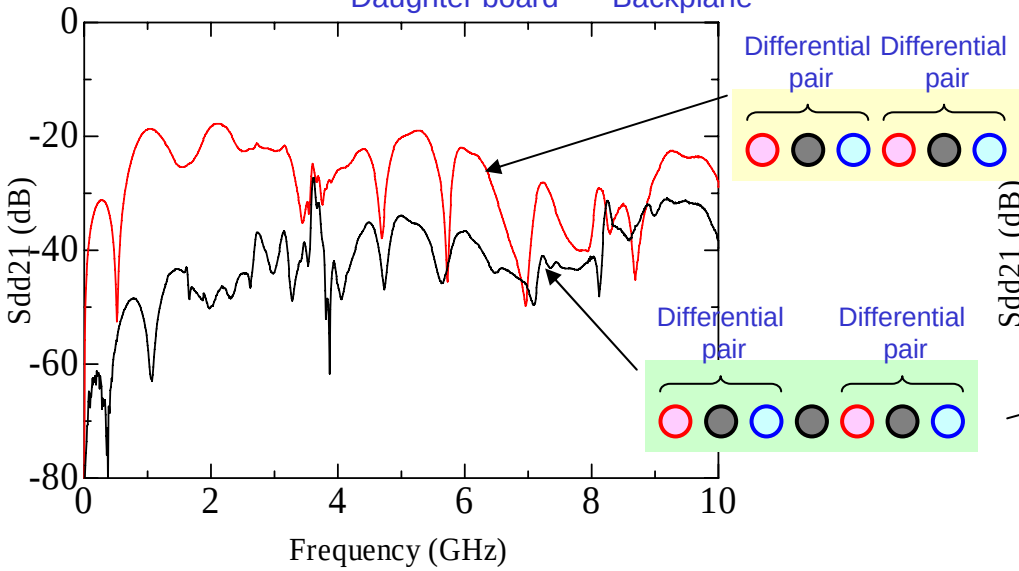
Differential insertion loss (Sdd21)



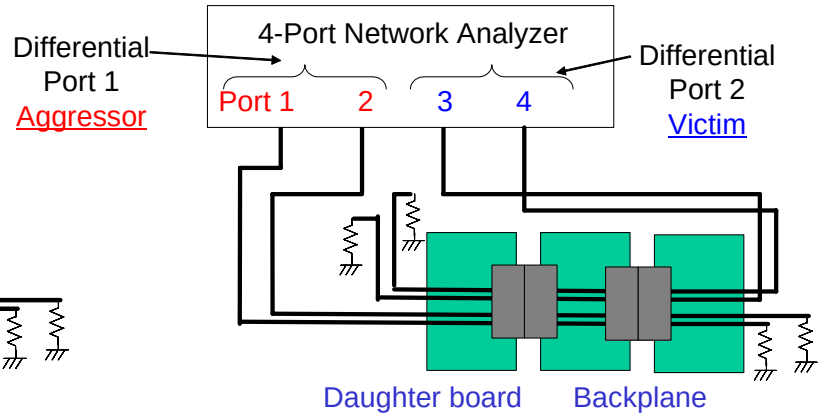
Crosstalk (S-parameter)

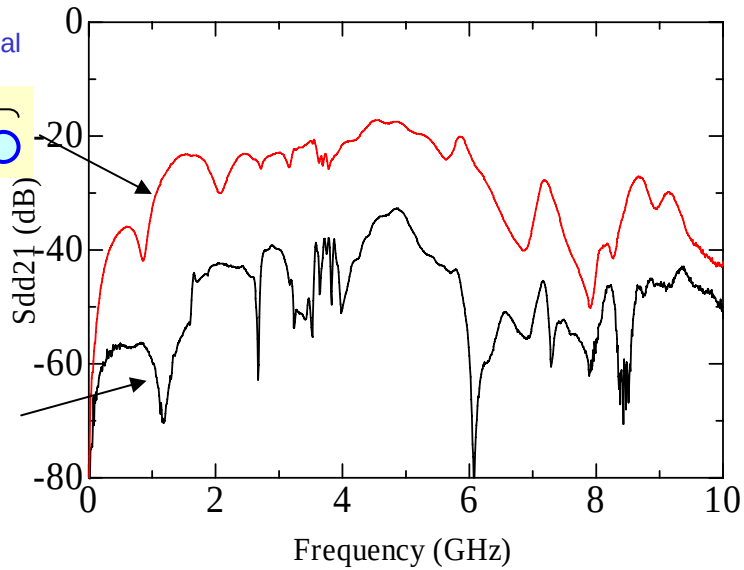
Near End Crosstalk





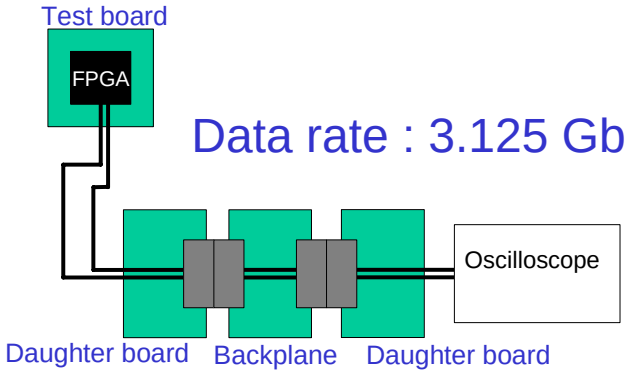
Far End Crosstalk



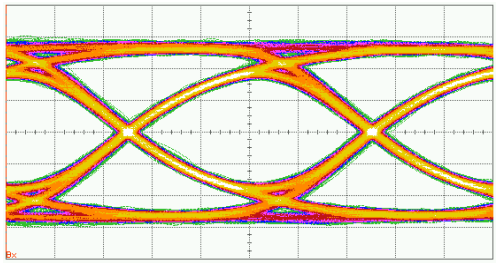


- GND pin is very effective to reduce crosstalk level

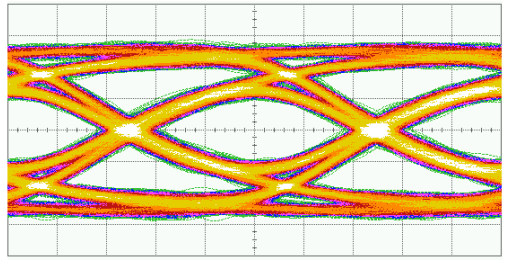
Eye Pattern



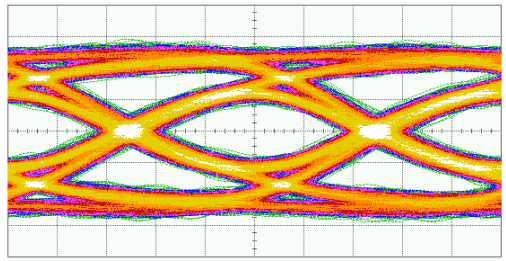
Data rate : 3.125 Gbps



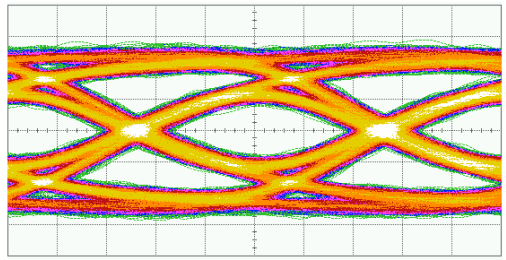
Input Waveform
Jitter = 34.9 ps



Short distance
Jitter = 82.6 ps



Middle distance
Jitter = 108.2 ps



Long distance
Jitter = 98.9 ps

- Jitter is 110ps at maximum, so it is possible to receive with nominal receiver.
- We have achieved to transmit over 3Gbps signals via the SpW BP system.
- Now, we are adjusting the BP to transmit much faster signals

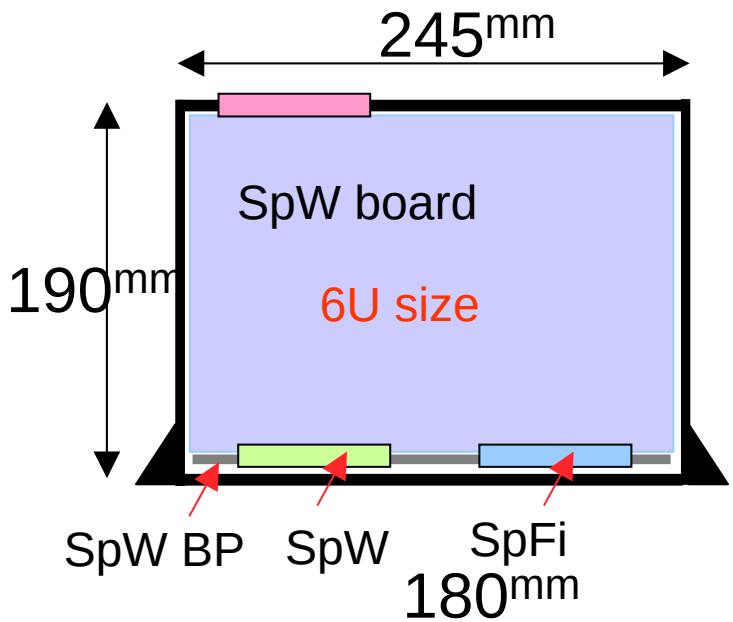
Contents

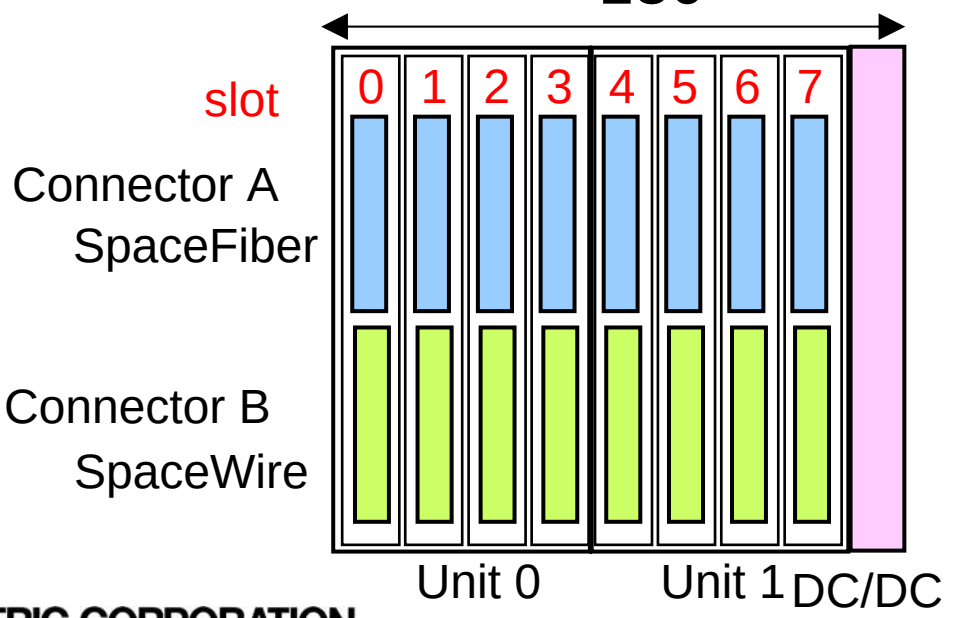
1. Introduction
2. Evaluation for the proto-type SpW BP
3. Investigation of Standard topology for SpW BP

Component Image

- Module
  - Size: 6U
  - Two connectors (SpW + SpFi)

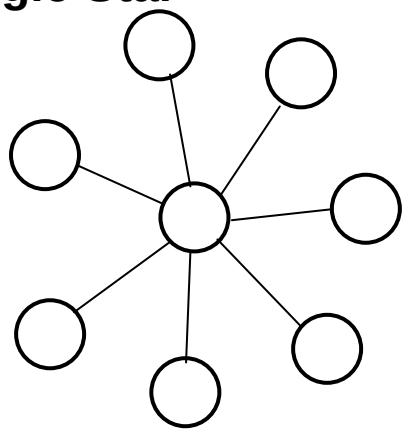
- Component
  - 8 modules + DC/DC
    - Internal redundant system
      - 4MDLs/1UNIT
      - 2UNITs/1COMP
    - Large system
      - 8MDLs/1UNIT
      - 1UNIT/1COMP
  - Size:190 x 180 x 245 [mm]





SpW Topologies

Single Star



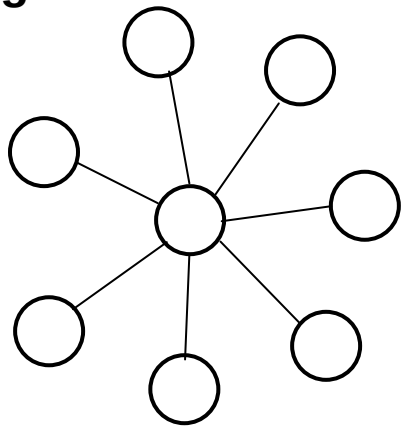
- Single star

1CPU + 7 I/F

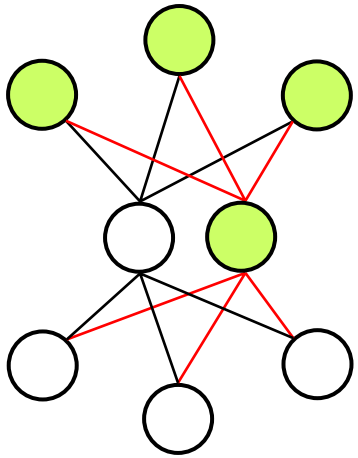
1Router+7modules

SpW Topologies

Single Star



Double Star



- Single star

1CPU + 7 I/F

1Router+7modules

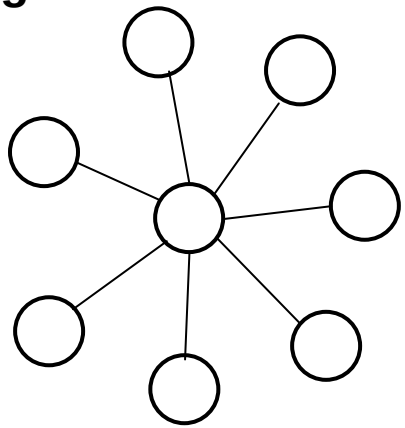
- Double star

Smaller than single

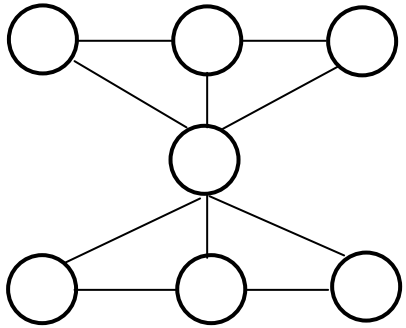
Board redundancy

SpW Topologies

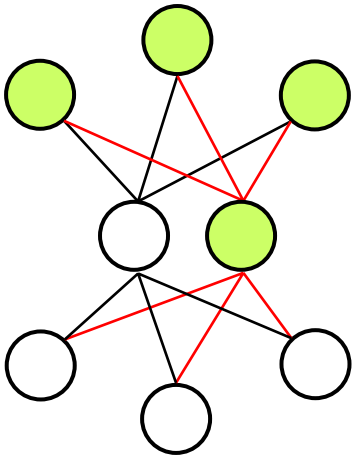
Single Star



Pipeline



Double Star



- Single star

1CPU + 7 I/F

1Router+7modules

- Double star

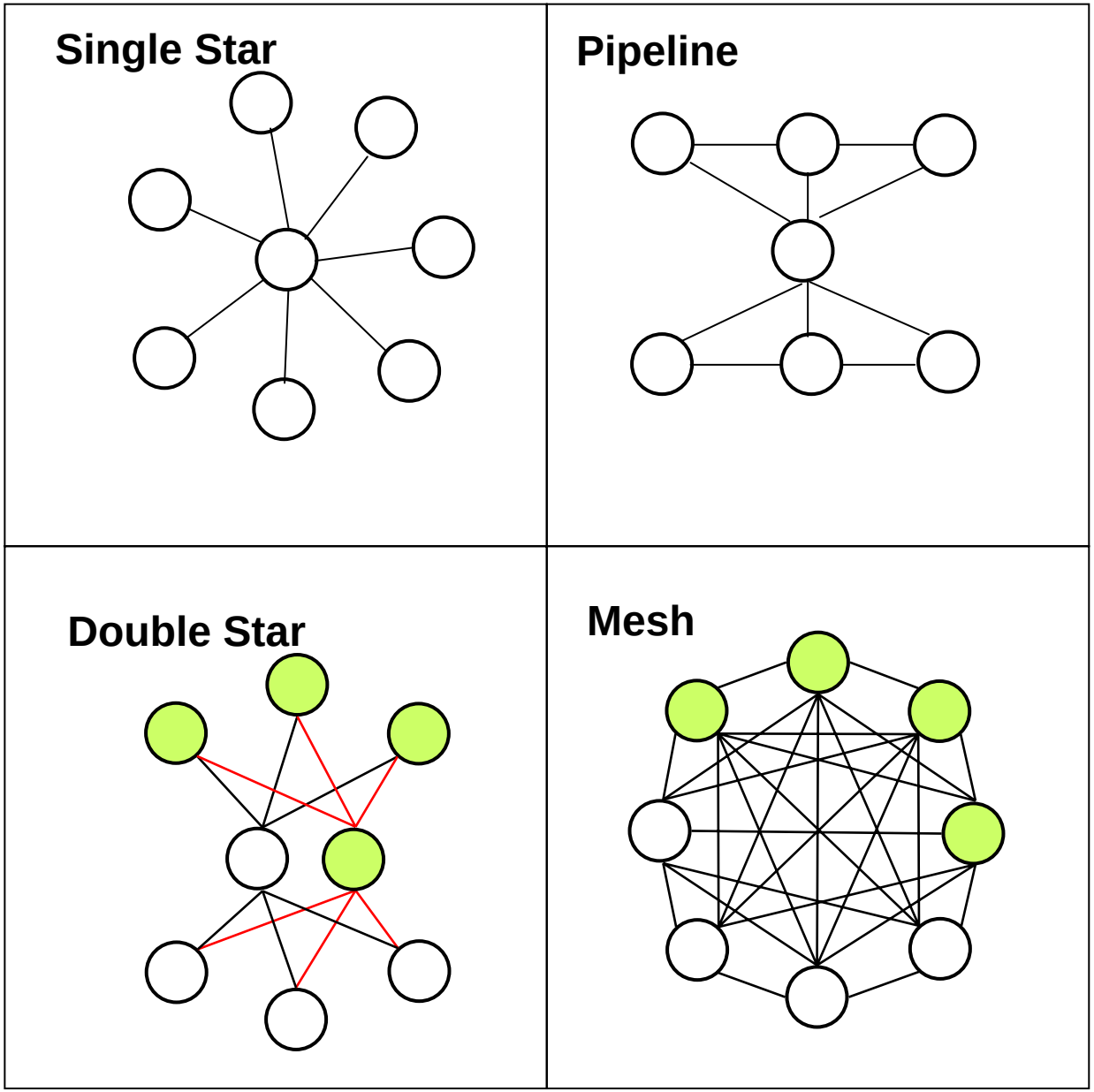
Smaller than single

Board redundancy

- Pipeline

Pipelined signal processor+controller

SpW Topologies



- Single star

1CPU + 7 I/F

1Router+7modules

- Double star

Smaller than single

Board redundancy

- Pipeline

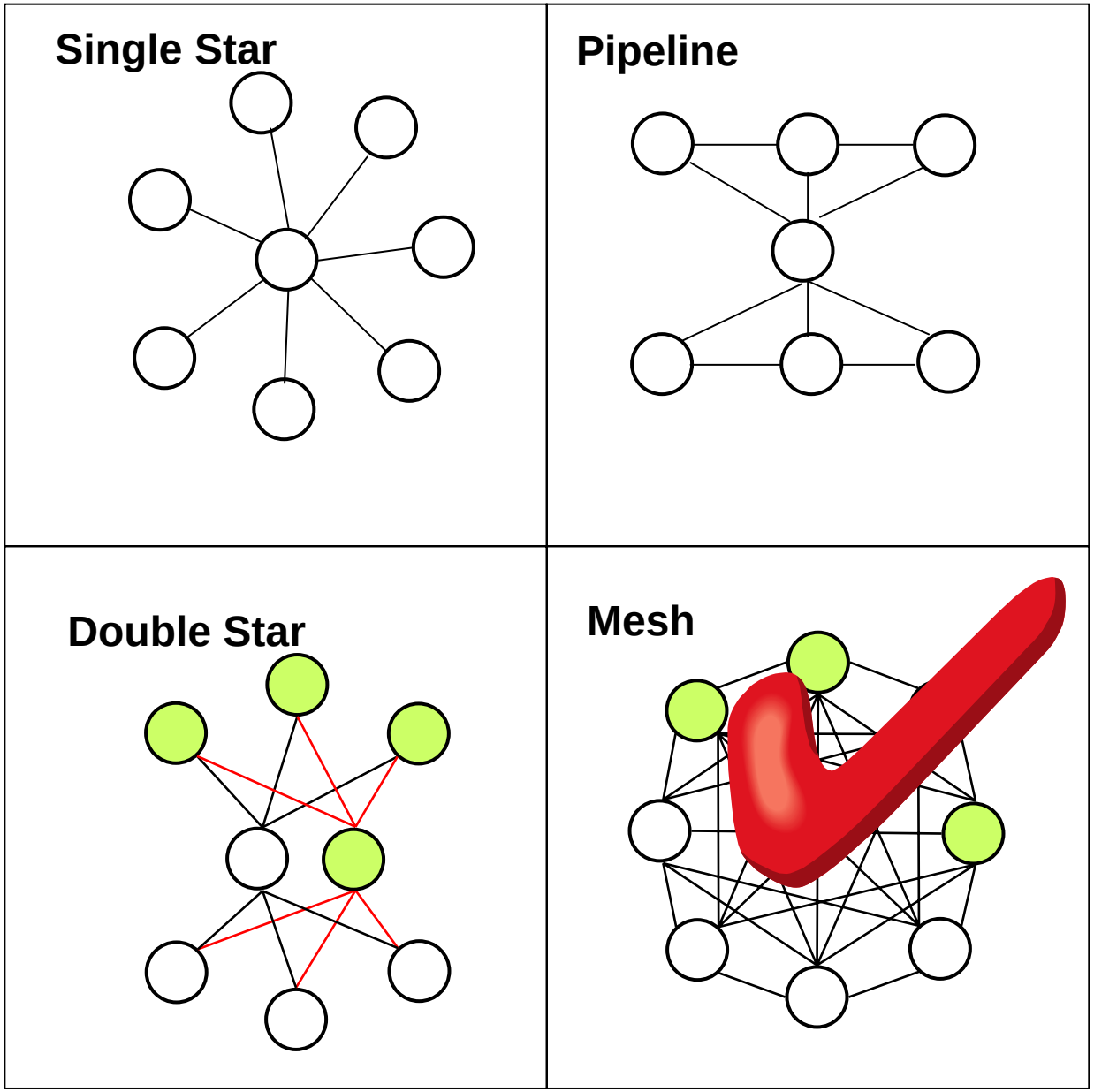
Pipelined signal processing+controller

- Mesh

Most flexble

7Spw port is Permissible

SpW Topologies



- Single star

1CPU + 7 I/F

1Router+7modules

- Double star

Smaller than single

Board redundancy

- Pipeline

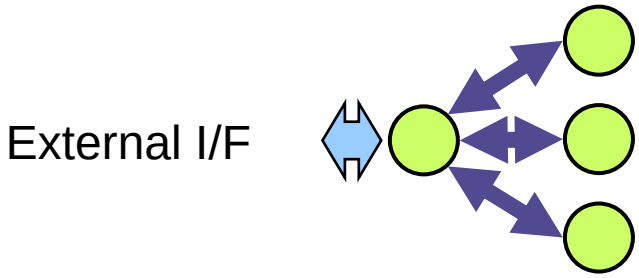
Pipelined signal processing+controller

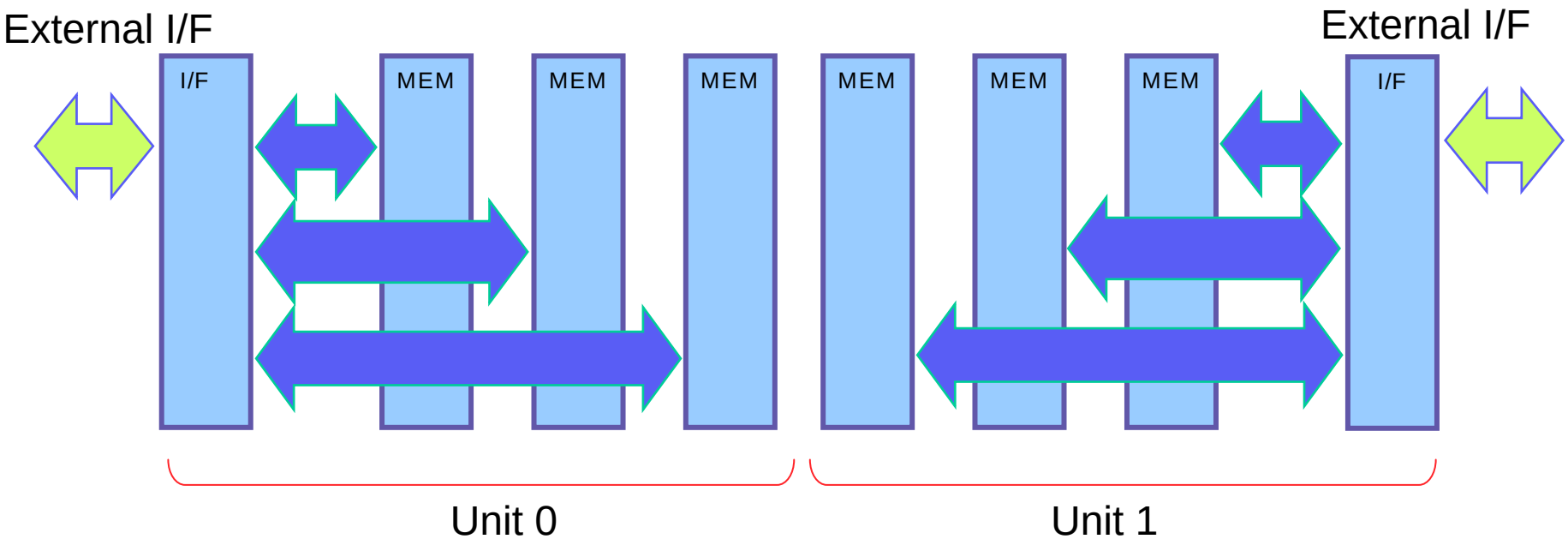
- Mesh

Most flexble

7Spw port is Permissible

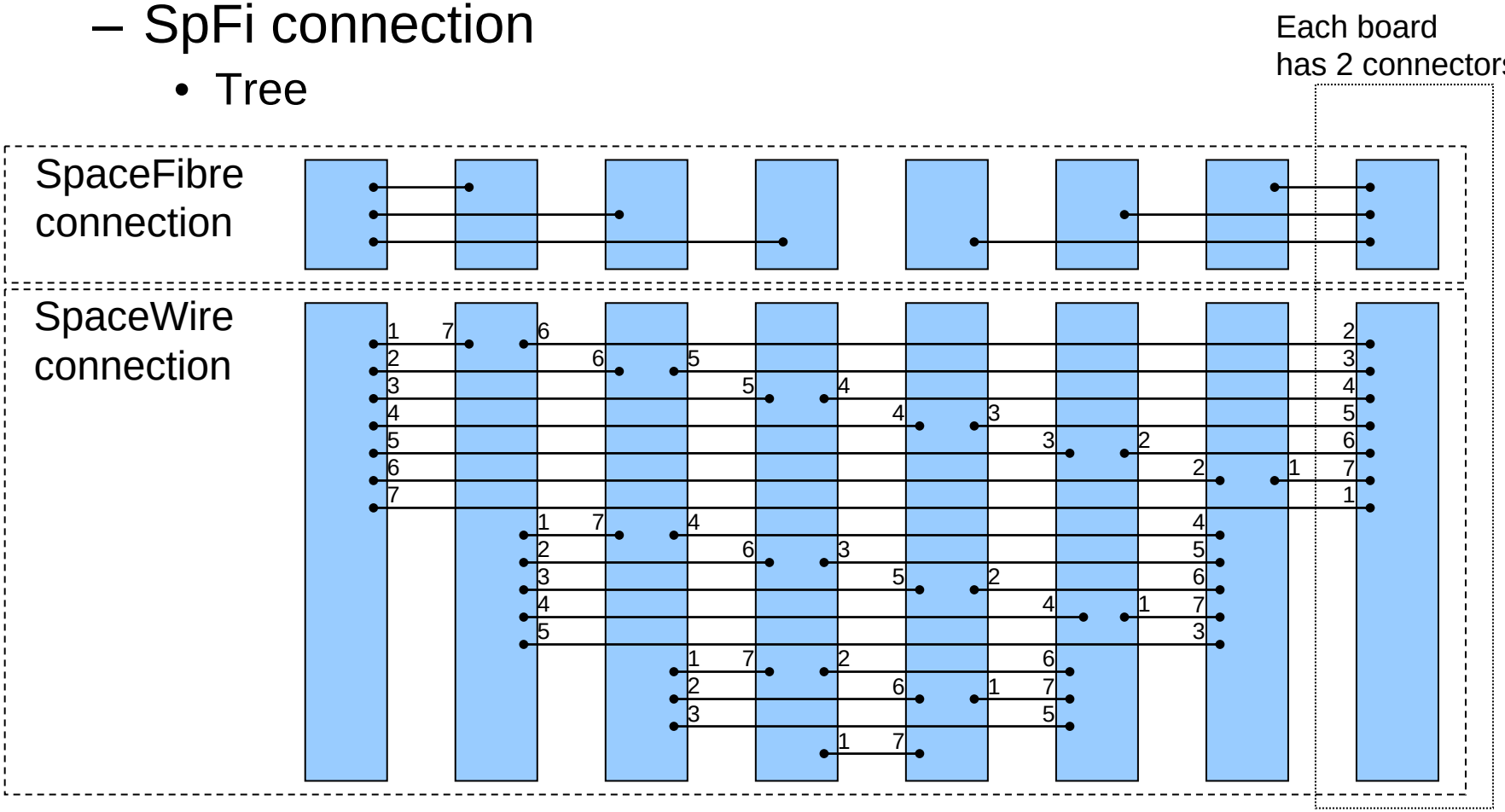
SpFi topology





Topology

- Full Mesh + Tree
  - SpW connection
    - Full mesh
  - SpFi connection
    - Tree



Summary and Plan

- We have achieved to transmit over 3Gbps signals via the proto-type SpW BP.
- We have proposed the topology for the standard SpW BP.
- Plan
  - Design and Manufacture of the SpW BP.
  - Design and Manufacture of demonstration model for the SpW component.
  - Evaluation of SpFi performance on the SpW BP.