98-0410: Proposed Modified Text for Methodology for Implementing Scalable Test Configurations.

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Overview

- Why these modifications to Appendix B?
- A simple/general methodology.
- Examples
- Summary

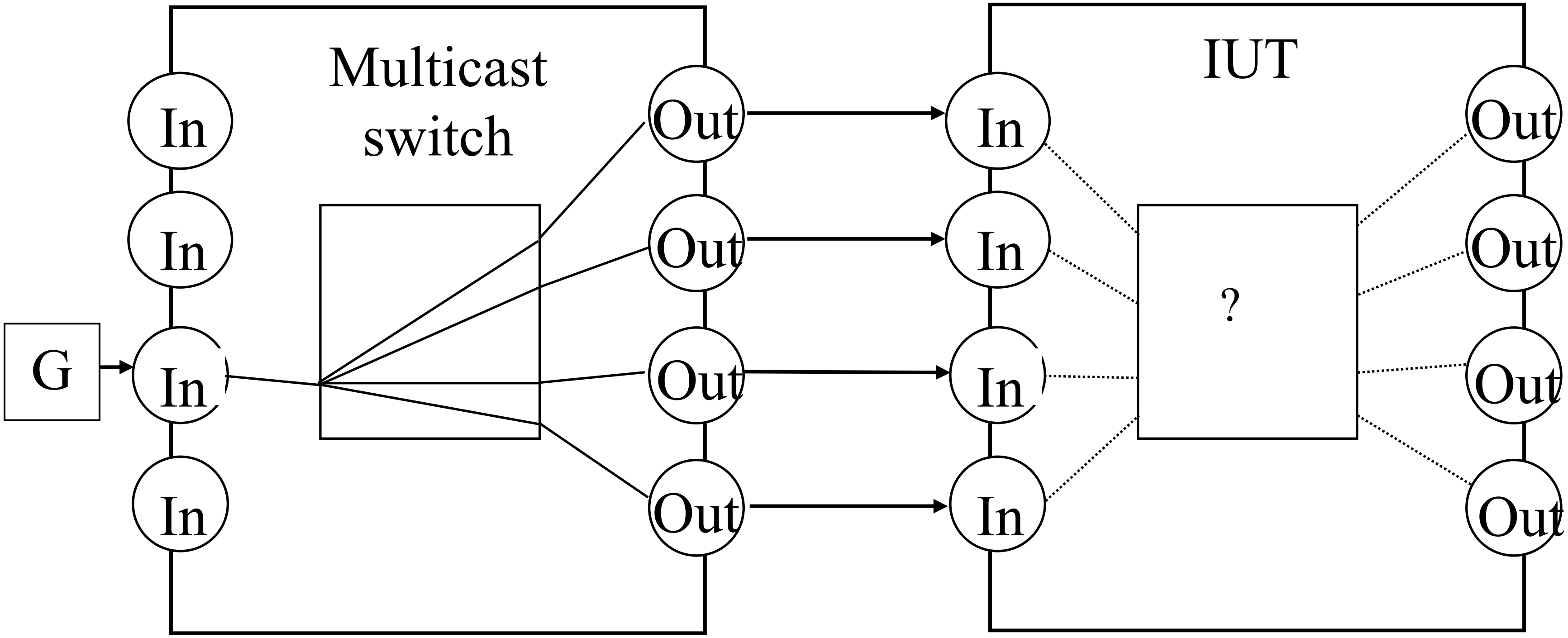
Why These Modifications?

- Appendix B describes two types of scalable configurations with loopbacks: unidirectional and bi-directional configurations .
- This contribution combines the best features of both of these types of configurations as "Serial Traffic Replication":
  - Bidirectionality - important for ABR traffic
  - General - can simulate all non-scalable configurations
- Also introduce "Parallel Traffic Replication"

Scalable Configurations

- ATM testing equipment are expensive.
- Scalable Configurations permit to simulate the desired basic configuration using a limited number of generators.
- Multiple configurations possible.

Parallel Traffic Replication



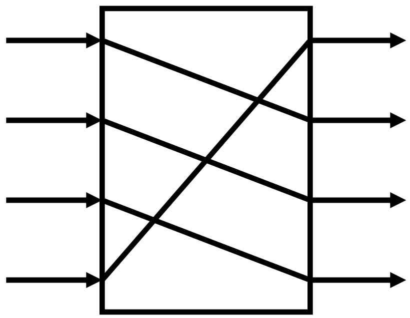
Parallel Traffic Replication (cont)

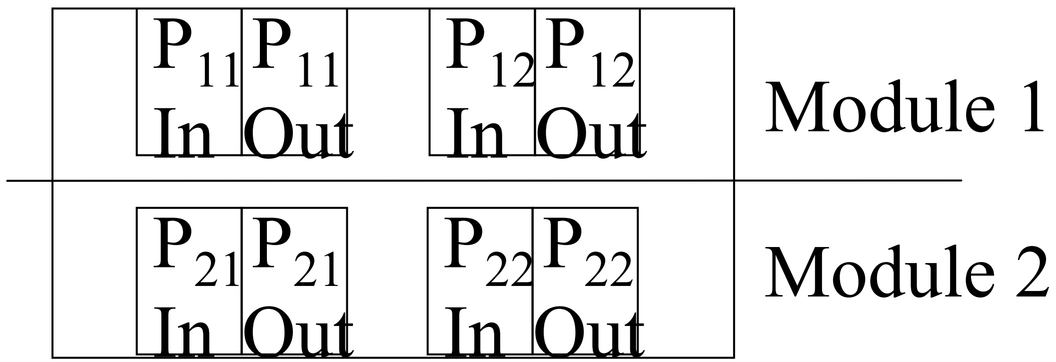
- The point-to-multipoint capability of a switch is used to generate the traffic inputs to the IUT.
- If the multicast switch does not support multipoint-to-point connections, then this form of parallel traffic replication cannot support bi-directional connection configurations.

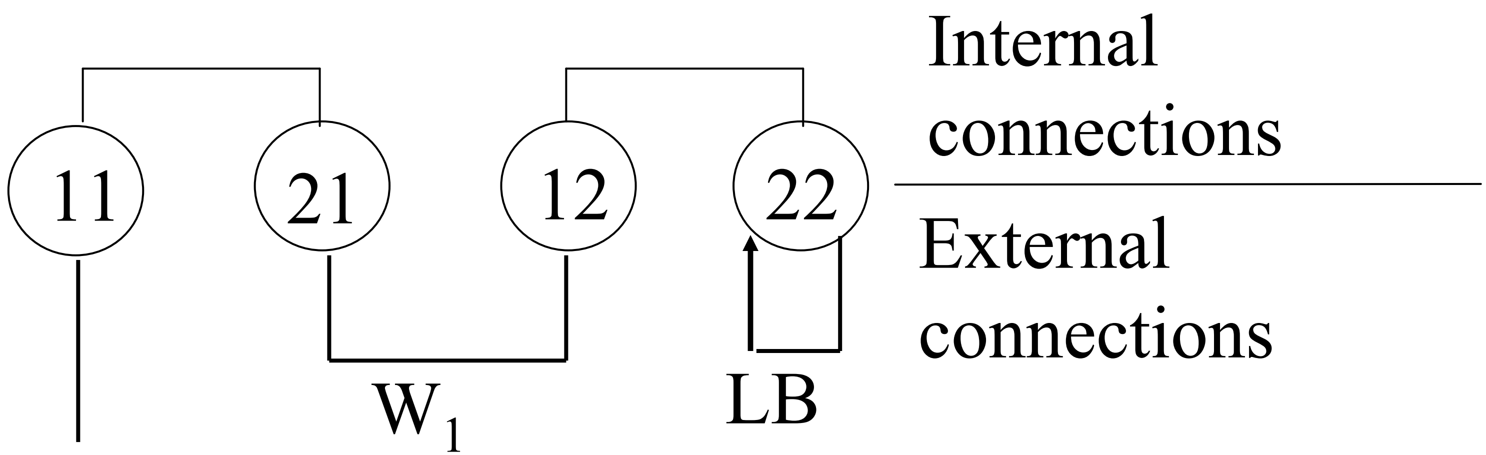
Serial Traffic Replication

- Testing requires virtual channel connections (VCCs) to be established through the switch.
- The VCCs are formed by setting up connections between ports of the switch.
- The connections are internal through the switch fabric and external through wires or fibers, depending on the port technology.
- An external connection between two switch ports is referred in this appendix as a wire W.
- The sequence of concatenated connections (internal and external) is called a VCC Chain

Example : 4-to-4 Configuration with One Generator







VCC Chain Implementation

- The following methodology given in the form of a algorithm, permits to implement standard VCC Chains for both scalable and basic configurations.
- Two phases :

  1) Implementation of External Connections

  2) Implementation of Internal Connections

Implementation of External Connections

- Three steps:
  1. Identify the modules to be included in the IUT and label the ports (using Pij format).
  2. Connect the generators and analyzers to appropriate ports.
  3. Establish and number external connections (wires) to use all the remaining ports of the IUT.

Step 1: Identify the modules to be included in the IUT

Module 1	P_{11} P_{12} P_{13} P_{14} P_{15} P_{16} P_{17} P_{18}	25 Mbps UTP
Module 2	P_{21} P_{22} P_{23} P_{24} P_{25} P_{26} P_{27} P_{28}	
Module 3	P_{31} P_{32} P_{33} P_{34} P_{35} P_{36}	155 Mbps single-mode fiber
Module 4	P_{41} P_{42} P_{43} P_{44} P_{45} P_{46}	

Step 1 (Cont)

- In order to ensure exclusively inter-module and/or intra-module internal connections, the IUT should consist of pairs of similar modules.
- Group the modules of the same port type
- It is not necessary to label the modules/ports, although we use the Pij format here to assist in the description of the methodology

Step 2: Connect the generators and analyzers to appropriate ports

- A port must be reserved for each generator/analyzer that is to be used in the test.
- These reserved ports cannot be used in the next step that establishes external connections.
- The methodology presented here allows any given number, $r \leq n$, of generators connected externally to any ports.

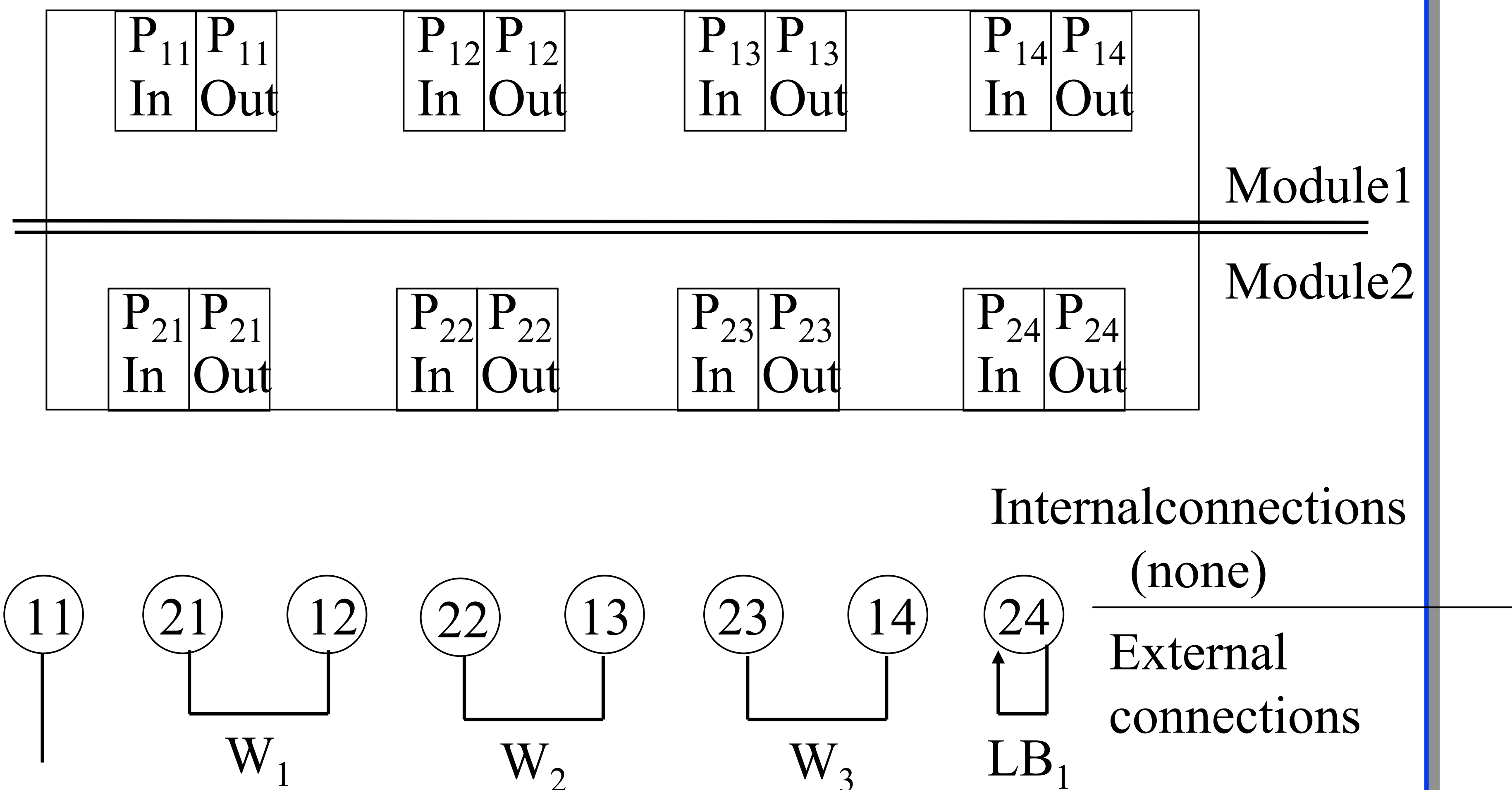
Step 3: Establish and number external connections

- Partition the remaining (non-reserved) ports into subgroups, whilst ensuring that there is an odd number of ports in each subgroup.
- To establish a "straight" connection configuration, assign each generator/analyzer to a subgroup.
- For other test configurations, such as "full cross" or "partial cross", more than one generator may be assigned to a subgroup.

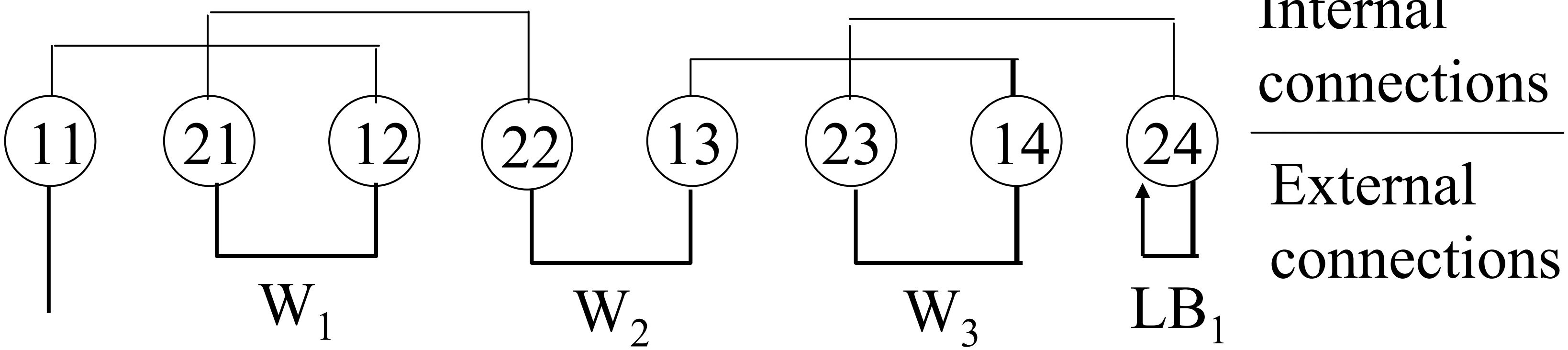
Step 3 (Cont)

- With *m* non-reserved ports in a particular subgroup (m being odd), the first *m-1* ports are pair-wise connected by wires, numbered consecutively from 1 across all subgroups.
- It is preferable that wires be established between ports on different modules to ensure that exclusively inter-module or intra-module traffic may be carried.
- Wires cannot connect ports of different types.
- The last (*m*th) port of each subgroup is occupied by a loopback, labeled as LB*g* for the *g*th subgroup.

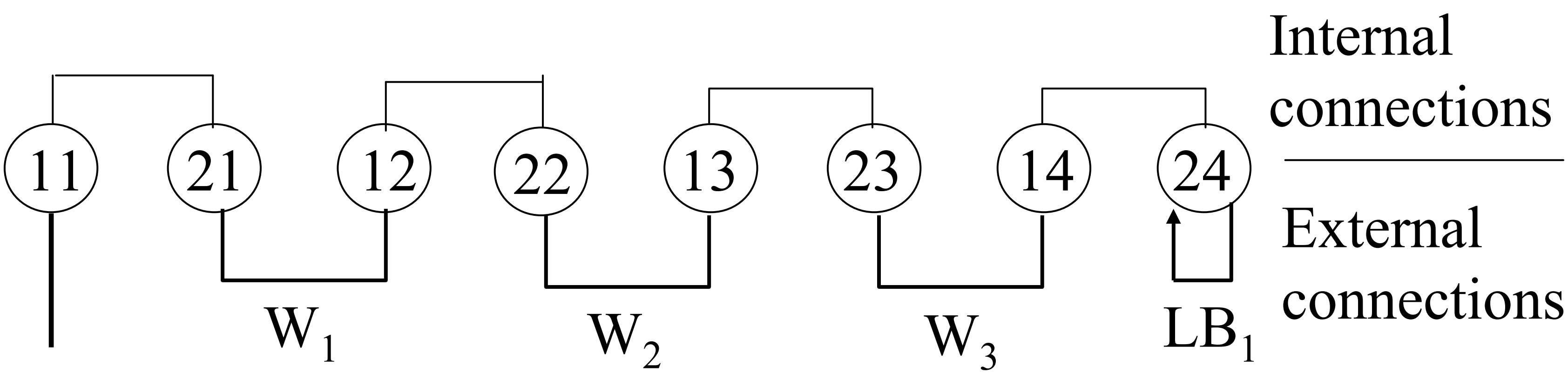
Example of External Connections



An 8-to-8 Straight Configuration



- Intra-module VCCs



- Inter-module VCCs

Implementation of Internal Connections

- Exclusively inter-module or intra-modules traffic is carried, depending on the implementation of the internal connections.
- A VCC chain is expressed :

  generator – ‘x wires in series’ – LB-

  – ‘x wires in reverse series’ – analyzer.

Internal Connections

1. Set $P_{in} = P_g$ and $i = 1$.
2. Set P_{out} = the port from W_i that is/isn't located on the same module as P_{in} for an intra/inter-module VCC chain, respectively.
3. Establish the bi-directional internal connection

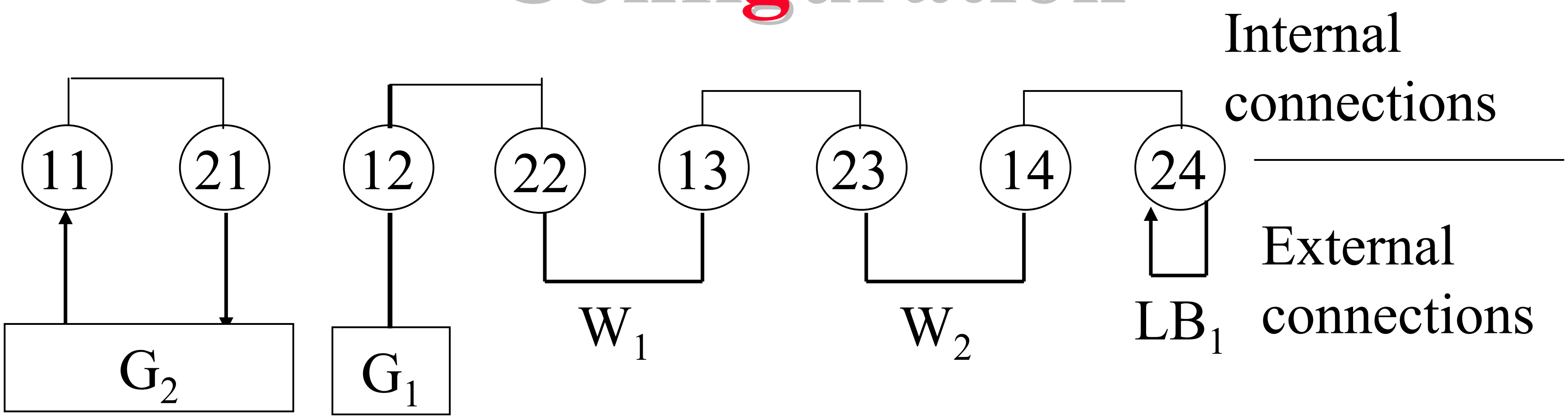
   $V_i = (P_{in}, P_{out})$.
4. Set P_{in} to be the other port from W_i (not P_{out}).
5. If ($i < x$), set $i = i+1$ and return to step 2, otherwise continue.
6. Establish the bi-directional internal connection

$$V_{x+1} = (P_{in}, P_{LB}).$$

Foreground vs Background

- Two kinds of virtual channel connections (VCCs):
  - Foreground VCCs (traffic that is measured) and
  - Background VCCs (traffic that simply interferes with the foreground traffic).
- Throughput measurements require only foreground traffic
- Latency measurements require both foreground and background traffic
- Foreground and background traffic may or may not use the same generator/analyzer

Background 6-to-6 Straight Configuration

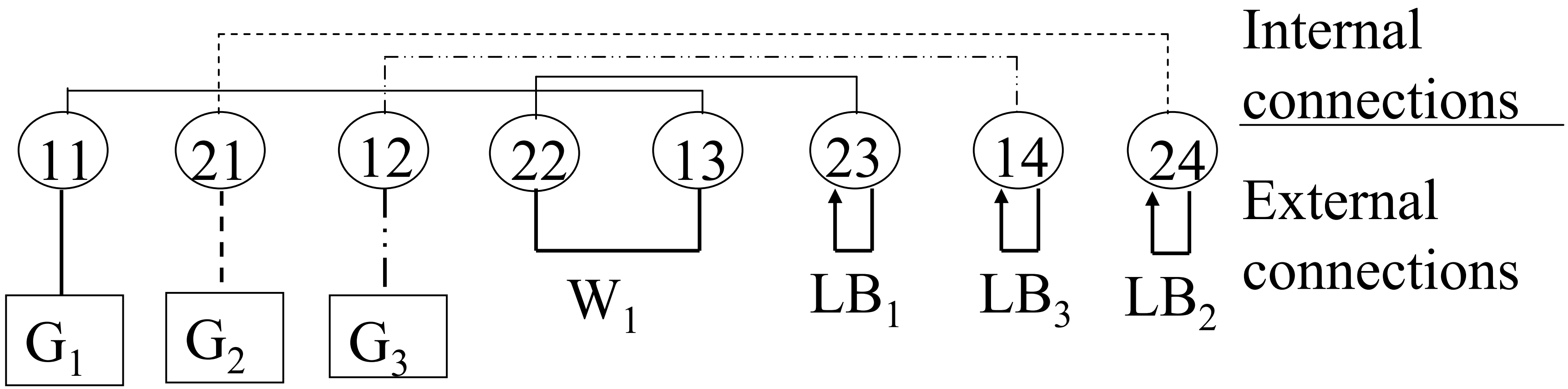


Inter module VCC Chain:

G_1-V_1-W_1-V_2-W_2-V_3-LB_1-V_3-W_2-V_2-W_1-V_1-G_1

$V_1 = (P_{12}, P_{22}), V_2 = (P_{13}, P_{23}), V_3 = (P_{14}, P_{24})$.

Foreground 8-to-8 Straight Configuration with 3 Generators



Three intra-module VCC Chains

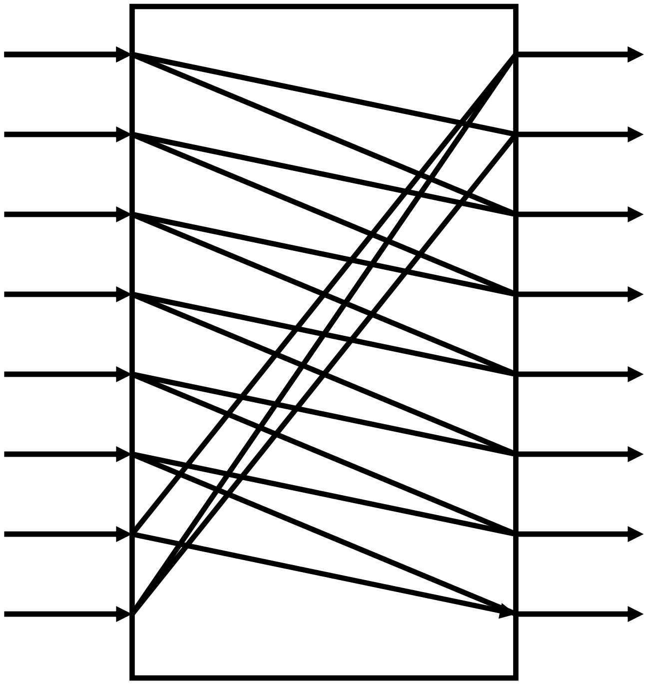
G_1-V_1-W_1-LB_1-W_1-V_1-G_1,

G_2-V_2- LB_2-V_2-G_2,

G_3-V_3- LB_3-V_3-G_3,

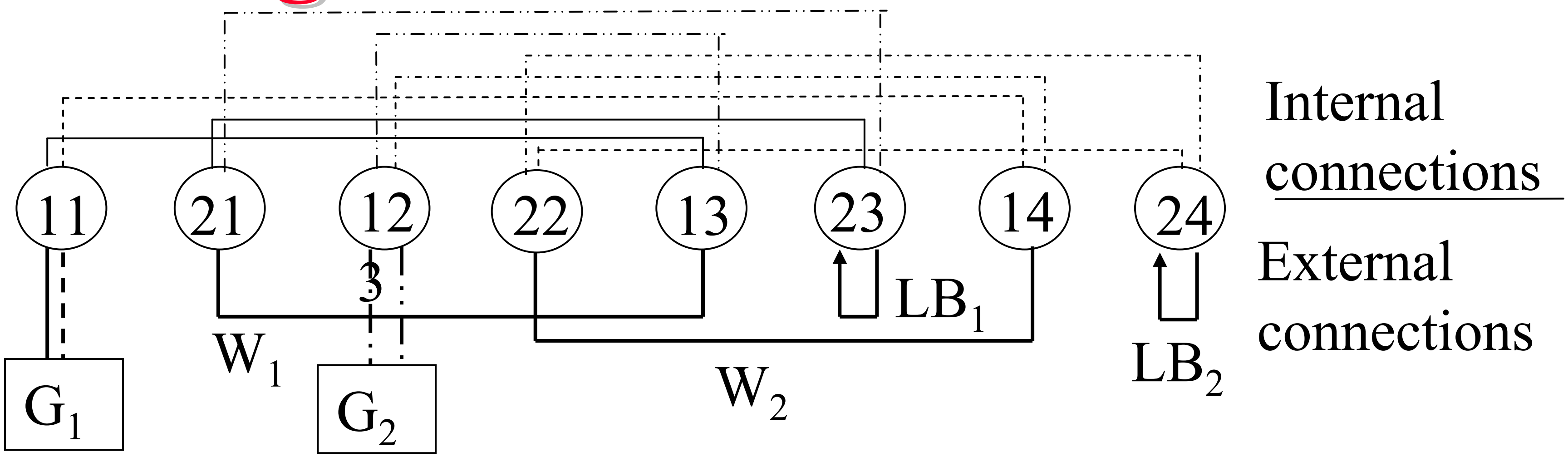
where $V_1 = (P_{11}, P_{13})$, $V_2 = (P_{21}, P_{24})$ and $V_3 = (P_{12}, P_{14})$

8-to-2 Partial Cross Throughput Foreground Traffic



- Basic 8-to-2 Partial Cross configuration

Foreground 8-to-2 Partial Cross Configuration with 2 Generators

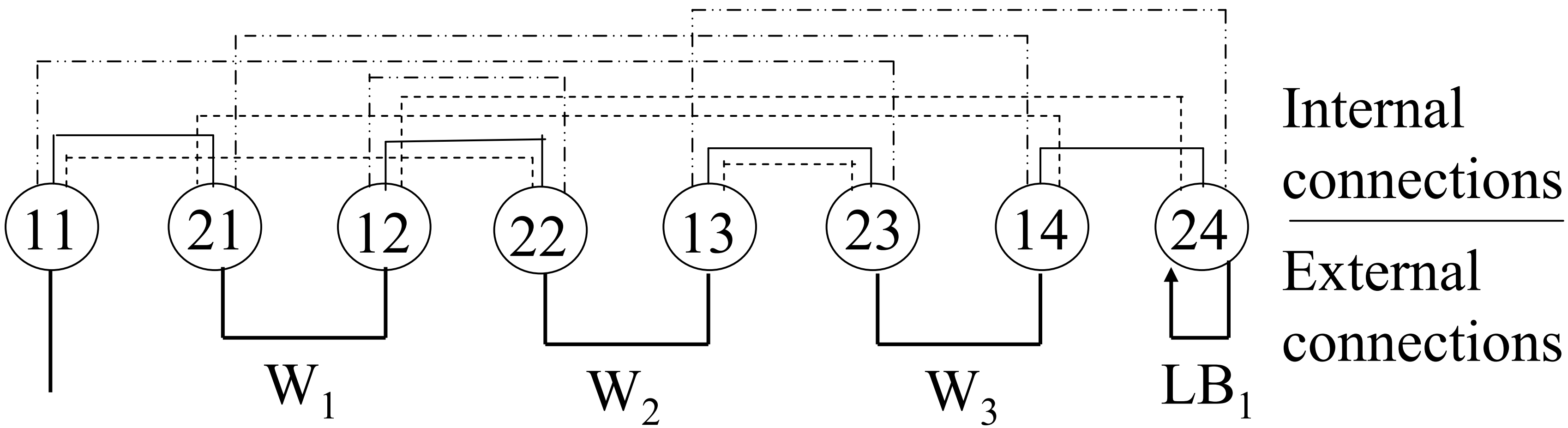


Four intra-module VCCs, two for each generator

G_1-V_1-W_1-V_2-LB_1-V_2-W_1-V_1-G_1, G_1-V_5-W_1-V_6-LB_1-V_6-W_1-V_5-G_1, G_2-V_7-W_2-V_8-LB_2-V_8-W_2-V_7-G_2, G_2-V_3-W_2-V_4-LB_2-V_4-W_2-V_3-G_2

where $V_1 = (P_{11}, P_{13})$, $V_2 = (P_{21}, P_{23})$, $V_3 = (P_{12}, P_{14})$, $V_4 = (P_{22}, P_{24})$, $V_5 = (P_{11}, P_{14})$, $V_6 = (P_{22}, P_{24})$, $V_7 = (P_{12}, P_{13})$, and $V_8 = (P_{21}, P_{23})$.

Foreground 8-to-3 Partial Cross with One Generator



Three inter-module VCCs :

$$G\text{-}V_1\text{-}W_1\text{-}V_2\text{-}W_2\text{-}V_3\text{-}W_3\text{-}V_4\text{-}LB_1\text{-}V_4\text{-}W_3\text{-}V_3\text{-}W_2\text{-}V_2\text{-}W_1\text{-}V_1\text{-}A,$$

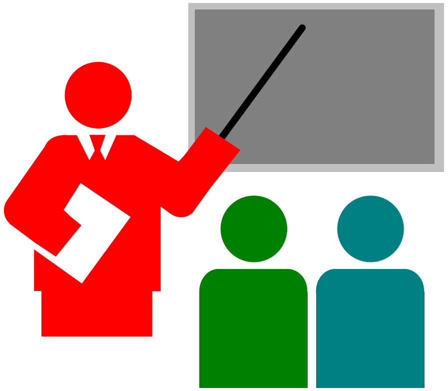
$$G\text{-}V_5\text{-}W_2\text{-}V_6\text{-}W_3\text{-}V_7\text{-}W_1\text{-}V_8\text{-}LB_1\text{-}V_8\text{-}W_1\text{-}V_7\text{-}W_3\text{-}V_6\text{-}W_2\text{-}V_5\text{-}A,$$

$$G\text{-}V_9\text{-}W_3\text{-}V_{10}\text{-}W_1\text{-}V_{11}\text{-}W_2\text{-}V_{12}\text{-}LB_1\text{-}V_{12}\text{-}W_2\text{-}V_{11}\text{-}W_1\text{-}V_{10}\text{-}W_3\text{-}V_9\text{-}A$$

Summary

- The new "Serial Traffic Replication" methodology is general and support bidirectional traffic flows.
  - It can be used for both scalable and basic configurations.
- Also introduced "Parallel Traffic Replication" using another multicast switch
- The methodology is simple and easily applicable.

Motion



- Adopt the text of 98-0410 as Appendix B of Performance Testing Baseline Text.