

TSN-IA Use Case Proposal

Hierarchical Domain based Network

IEC/SC65C/MT9=IEEE802.1/JWG P60802

Taro Harima: Mitsubishi Electric

2018-05-22

Contents

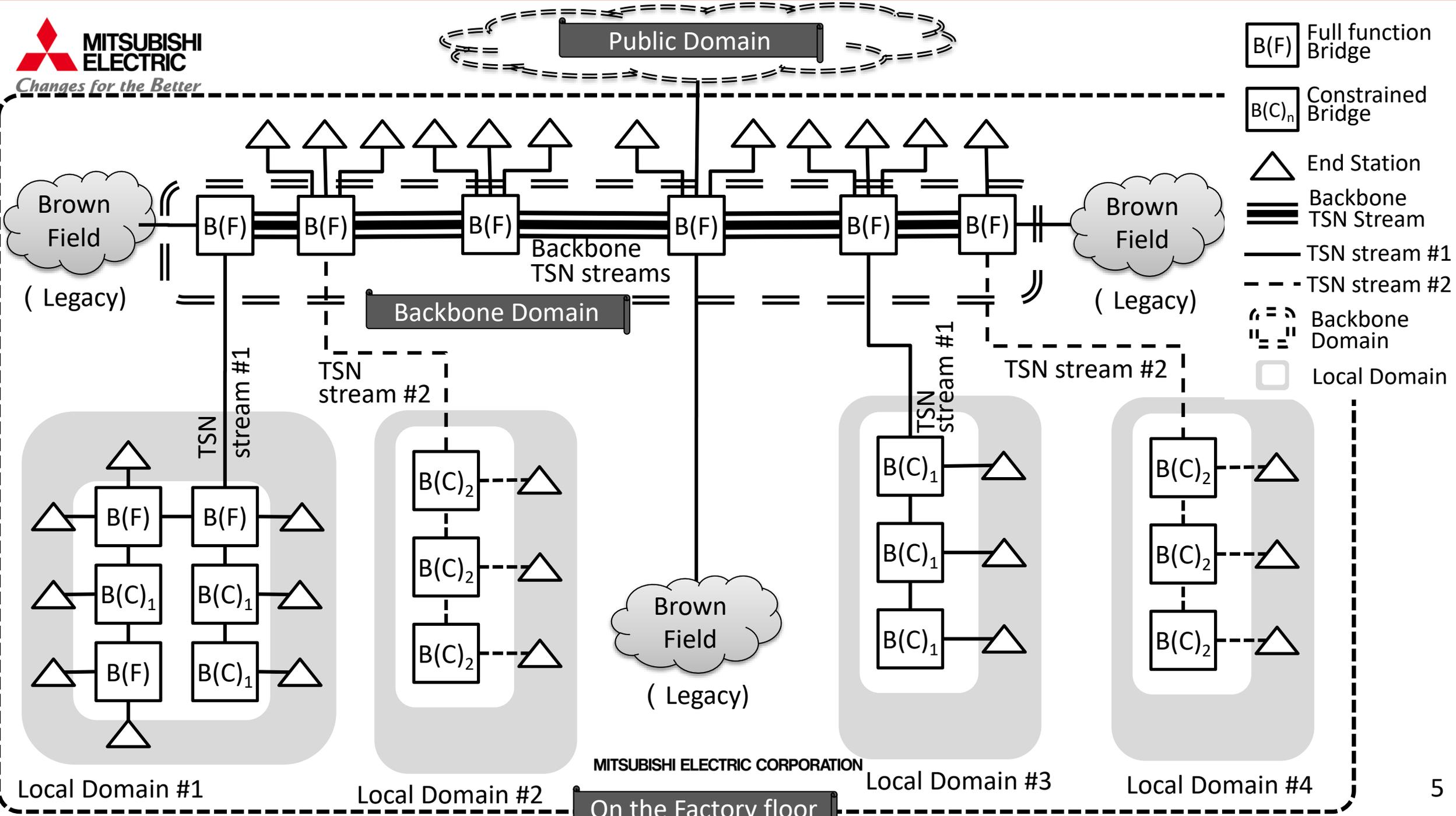
- Domains
- The Use case
- Bridges

Revision

- Terms
 - Revision
 - Domain definition
 - Backbone Domain ← Public Domain
 - Local Domain ← Private Domain
 - Public Domain
 - Brown Field
 - Bridge availability
 - Full functional Bridge B (F) ← FB
 - Constrained Bridge B (C) ← CB

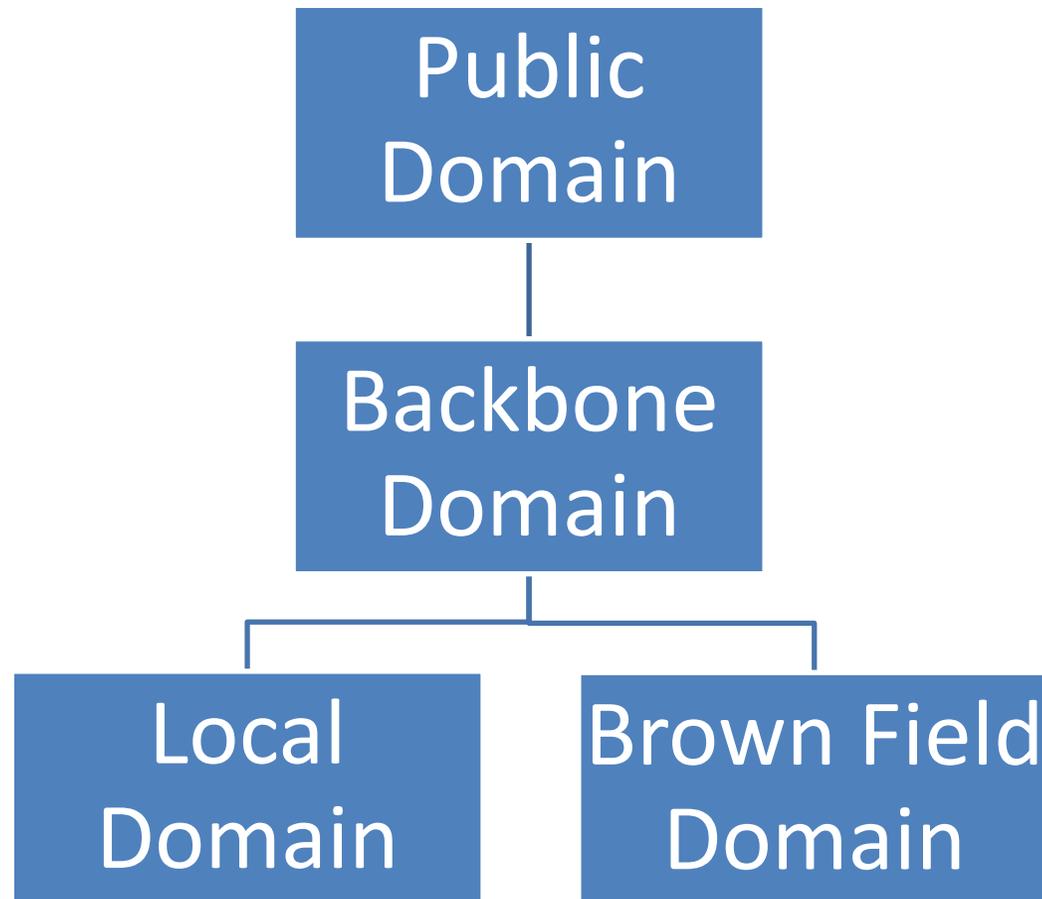
Overview

- A Hierarchical network system has
 - Local Domain: Enclosed Domain with TSN
 - Backbone Domain: Inter-domain connections including TSN
- This configuration is popular in the Factory Automation industry, which accounts for two-third of the Industrial Automation Network nodes.
- Local Domains offer concurrent development, multi-vendor purchasing and protection from fault interference.
- Backbone Domain interconnects between Local domains and/or brown field domains.
- Bridges
 - Full function Bridge : B(F)
 - It equips whole function of TSN which is defined in IEEE802.1 TSN specification.
See P22 in <<http://www.ieee802.org/1/files/public/docs2017/tsn-farkas-intro-0517-v01.pdf>>
 - Constrained function Bridge: B(C)
 - Subset of Full function Bridge
 - Minimum requirement and options for Industrial Automation



Domains

- Public Domain
- Backbone Domain
- Local Domain
- Brown Field Domain
(Legacy)



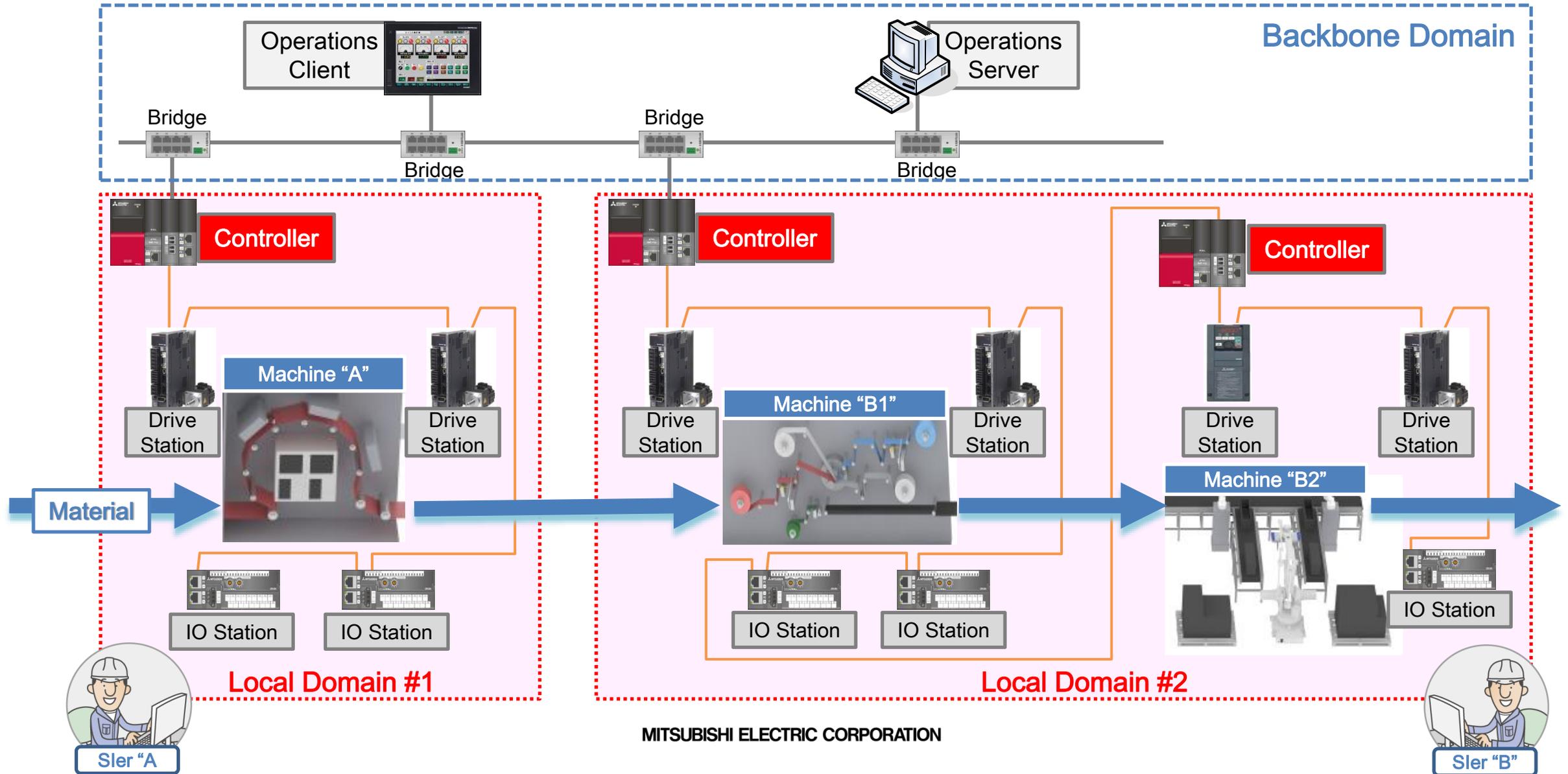
Local Domain

- Enclosed Domain with TSN
 - Enclosed Brand new domain with TSN
 - Some brown field may migrate to the Local domain to add TSN.
- Constrained access from outside
 - It connects with Backbone at only one interface.
 - Nothing can directly access internal entities from outside.
- Predefined configuration.
 - Only designated communications including TSN streams run in the specified Local Domain.
 - Configuration is static and fixed, but may be allocated dynamically.

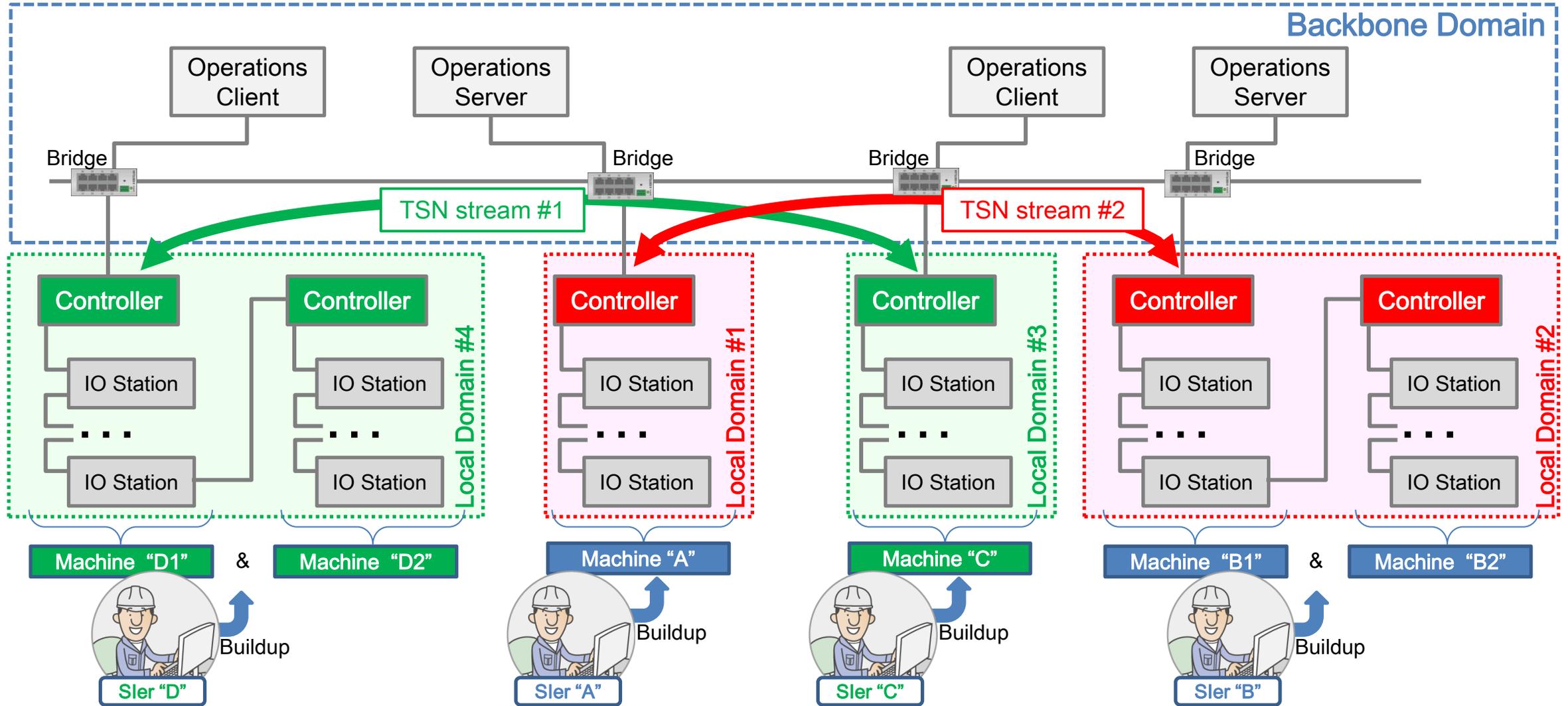
Backbone Domain

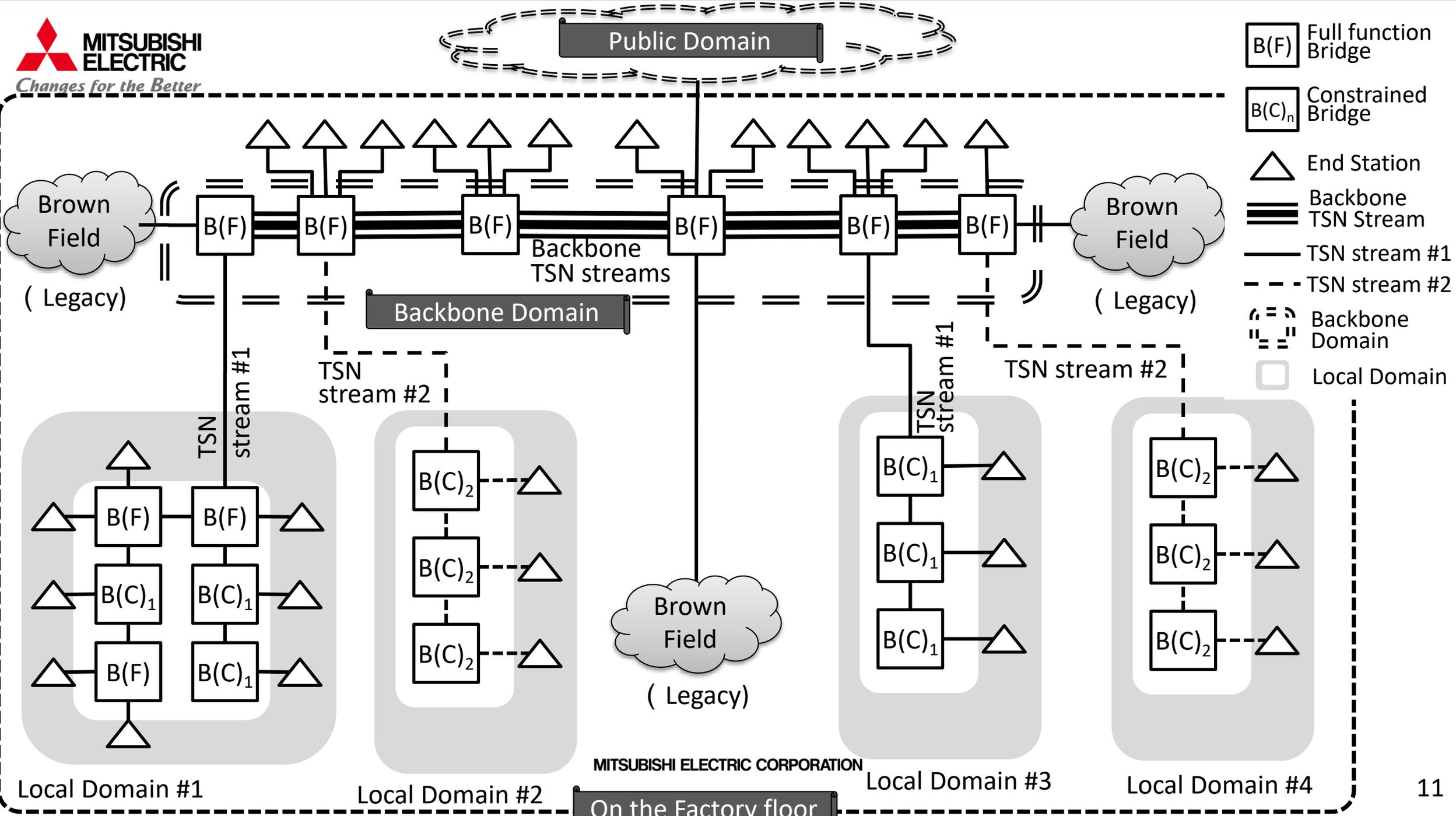
- Inter-domain connections including TSN
- Inter-domain access
 - It connects with Local Domains, but it may connect to the Public Domain and the other domains (ex. OA domains, etc.)
 - Anything can directly access internal entities from outside.
- Dynamic configuration
 - Any communications include any TSN streams can run through them.
 - Configuration is allocated dynamically.

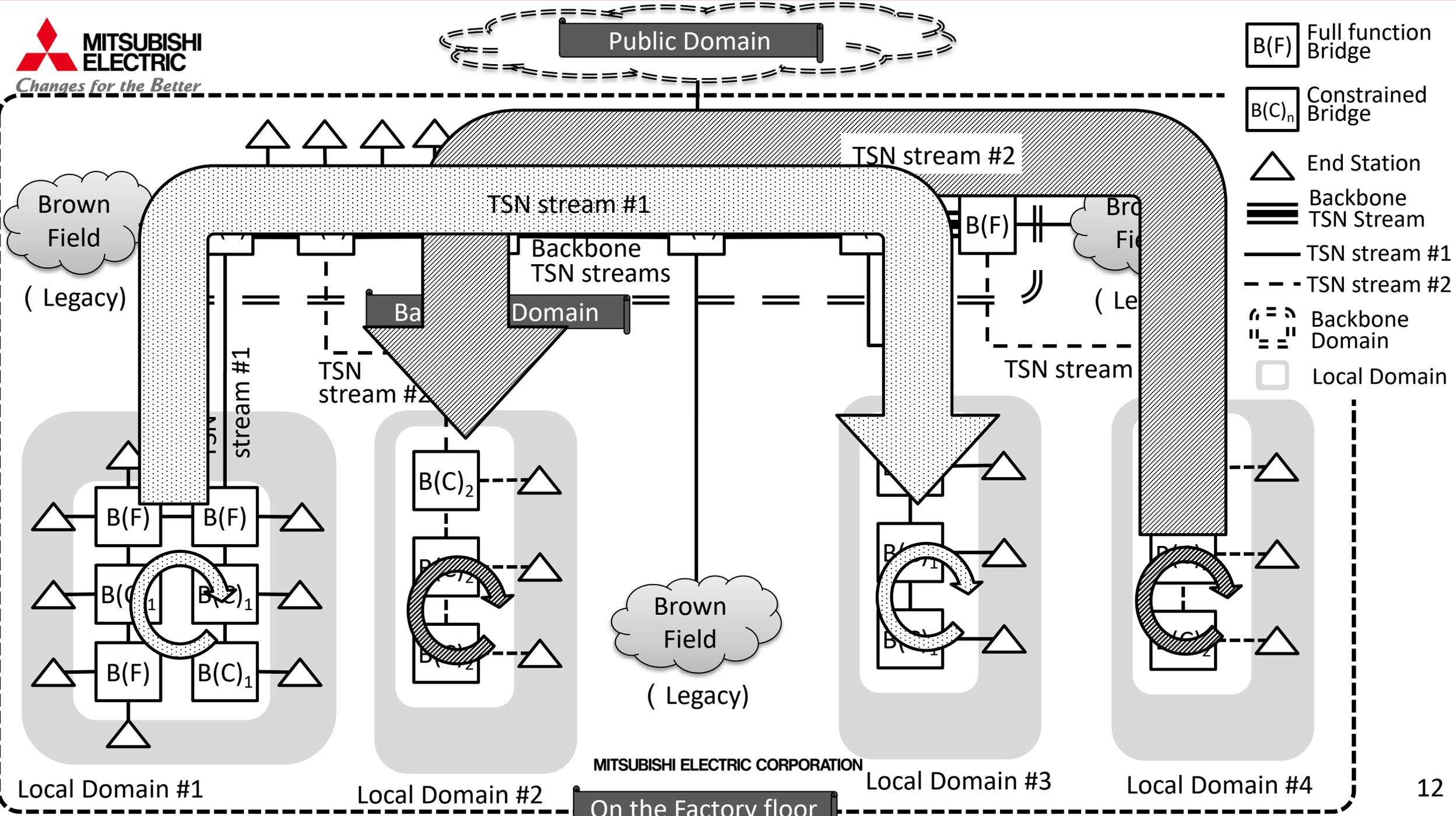
System Image in Use Case 1



Multi TSN streaming in Use Case 1







- B(F) Full function Bridge
- B(C)_n Constrained Bridge
- △ End Station
- ≡ Backbone
- ≡≡≡ TSN Stream
- TSN stream #1
- - - TSN stream #2
- ⌞ ⌟ Backbone Domain
- ⌞ ⌟ Local Domain

MITSUBISHI ELECTRIC CORPORATION

On the Factory floor

Full function Bridge: B(F)

- It is suitable for the Backbone Domain.
- It shall multiplex between two and more real-time communications and non real time communications.
- It shall support any TSN stream classes.
- It shall support dynamic configuration.
- It shall supervise configuration and security [802.1X etc.] of traffics between Local Domains, other domains and Public Domain.

Constrain Bridge : B(C)

- It is suitable for the Local Domain.
- It shall multiplex between one Real Time communication and non Real Time communications,
And it may multiplex between Real Time communications and non Real Time communications.
- It shall support a couple of specified TSN stream classes.
- It shall support Predefined configuration.
- It is subset of the Full functional Bridge : B(F).

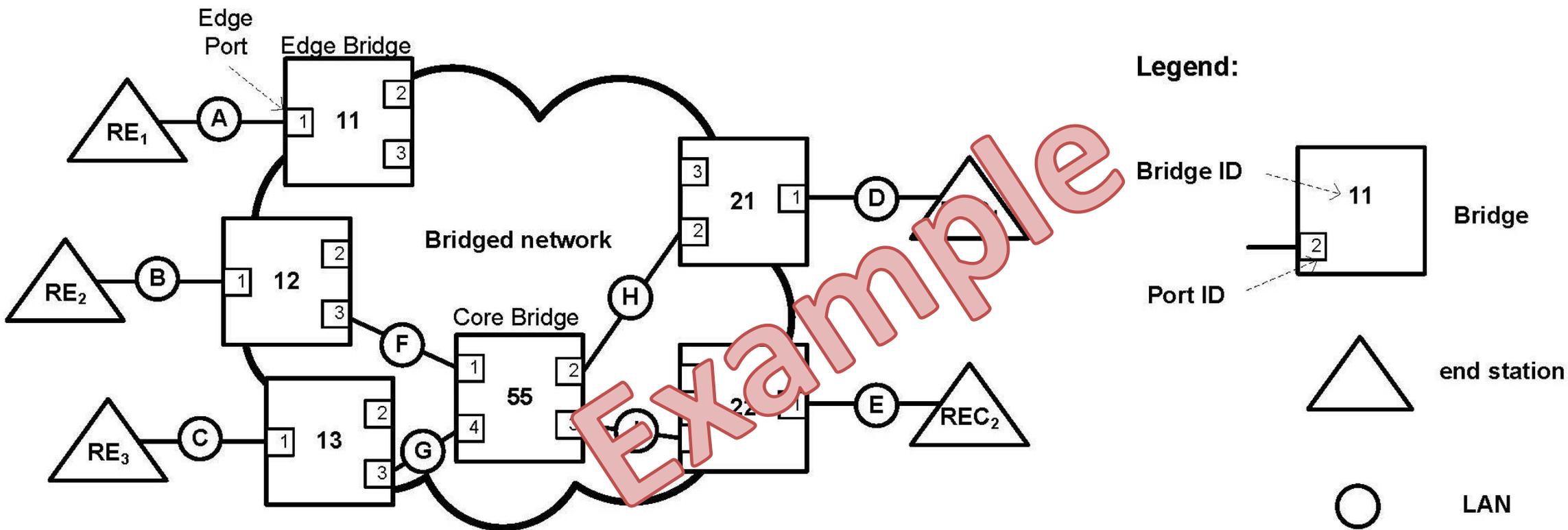
Bridges

	Full function Brdg. B(F)	Constrain Brdg. B(C)	Conventional Brdg. w/o TSN func.
Public Domain	Applicable	Applicable	Applicable
Backbone Domain	Applicable	Not Applicable	Not Applicable
Local Domain	Applicable	Applicable	Not Applicable
Brown Field	Applicable	Applicable	Applicable

Which Domain is the Project Scope?

- Backbone Domain only
- Backbone Domain and Local Domains
- Local Domains only
- Further Study (You, Do it !)

Unified Network Figure



802.1Q Model from tsn-farkas-intro-1116-v02

Review of Use case 17

- Where are bridges?
- No Backbone domain

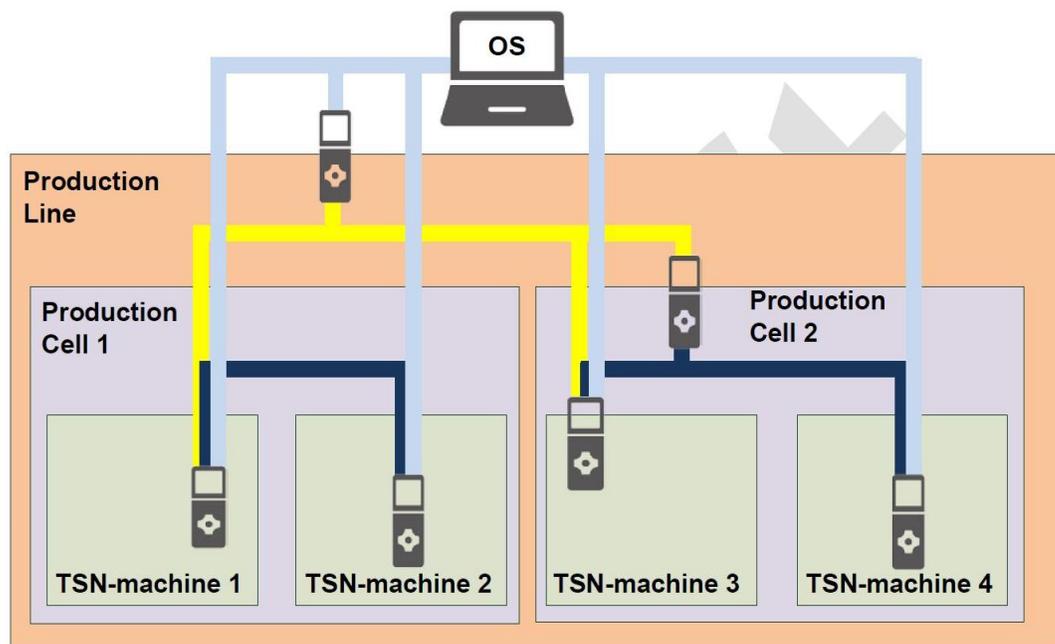


Figure 36 – M2M in hierarchical domains

