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TSN-IA Use Case Proposal Hierarchical Domain based Network

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

- Terms
  - Backbone Domain ⇦ Public Domain
  - Local Domain ⇦ Private Domain
- Review of similar use cases

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Overview

- A Hierarchical network system has
  - Local Domain which interconnects devices in Factory installation
  - Backbone Domain which interconnects between Local Domains and other domains (Public Domain, OA domains etc.).
- 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-vender procurement and protection from fault interference.
- Bridges
  - Full function Bridge (FB)
    - 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 (CB)
    - Subset of FB
    - Minimum requirement and options for Industrial Automation

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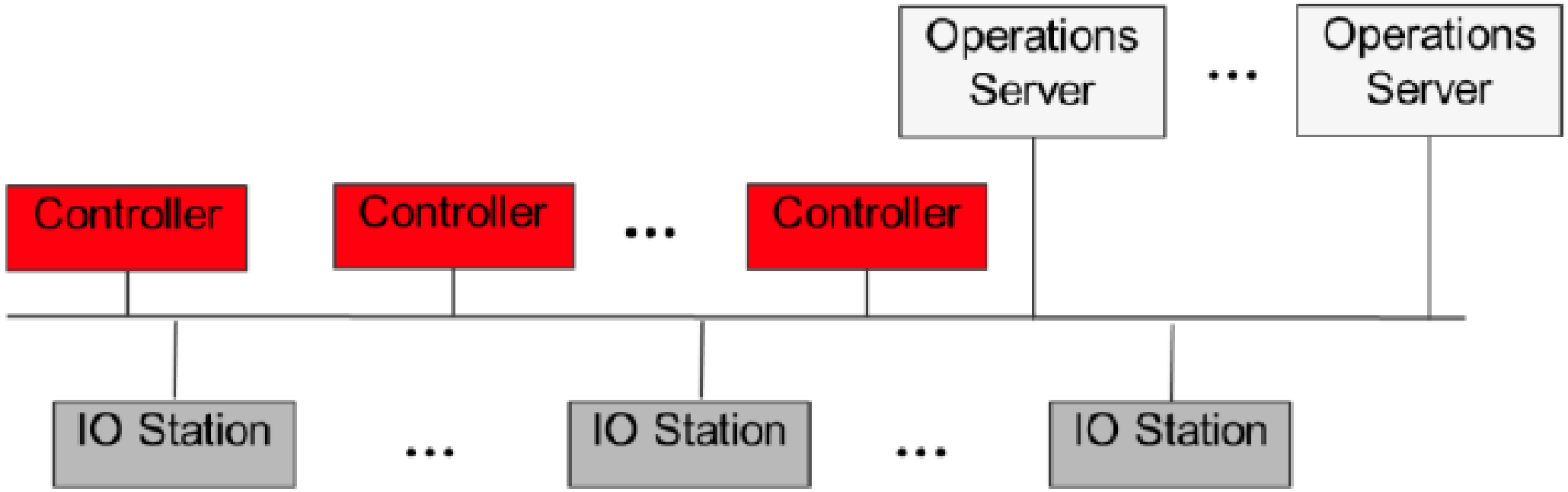
Review of Similar Use cases

- There are two similar use cases in Mr. Dorr's contribution (Ver. 5).
  - Server consolidated logical connectivity
    - Subclause 2.2.4, Figure 5
  - Pass-through one machine and production cell
    - Clause 3, Figure 9

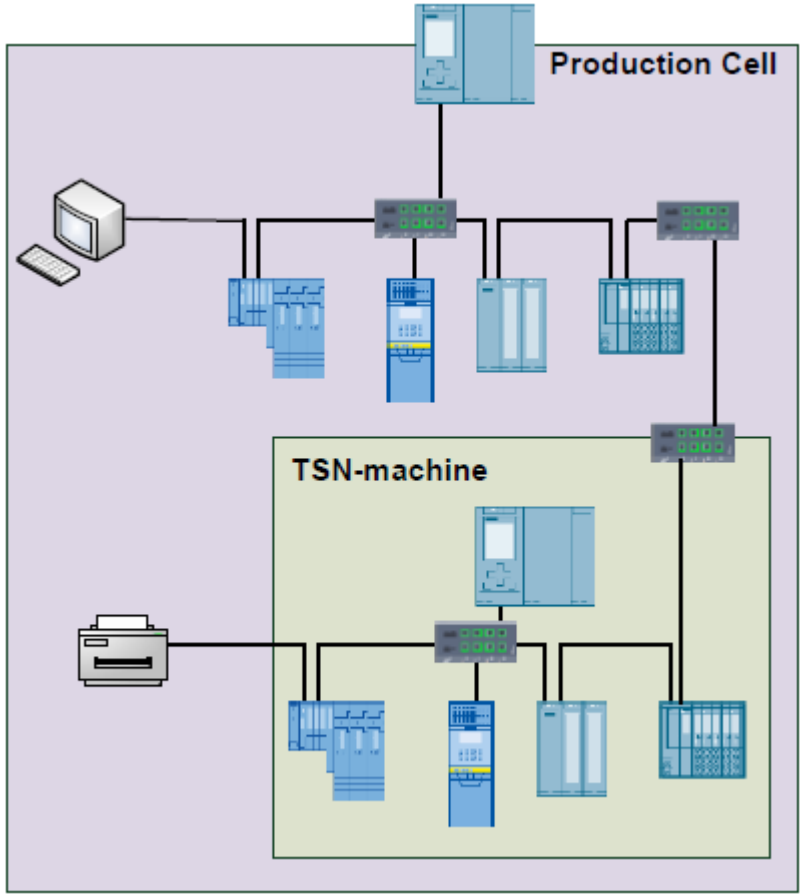
Server consolidated logical connectivity

- This use case shows the flat network, and there is no hierarchy.



Pass-through one machine and production cell

- This use case shows the flat network, and there is no hierarchy.
- This use case shows no inter-domain communication.



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Local Domain

- 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 include any TSN streams run there
  - Configuration is static and fixed, but may be allocated dynamically.

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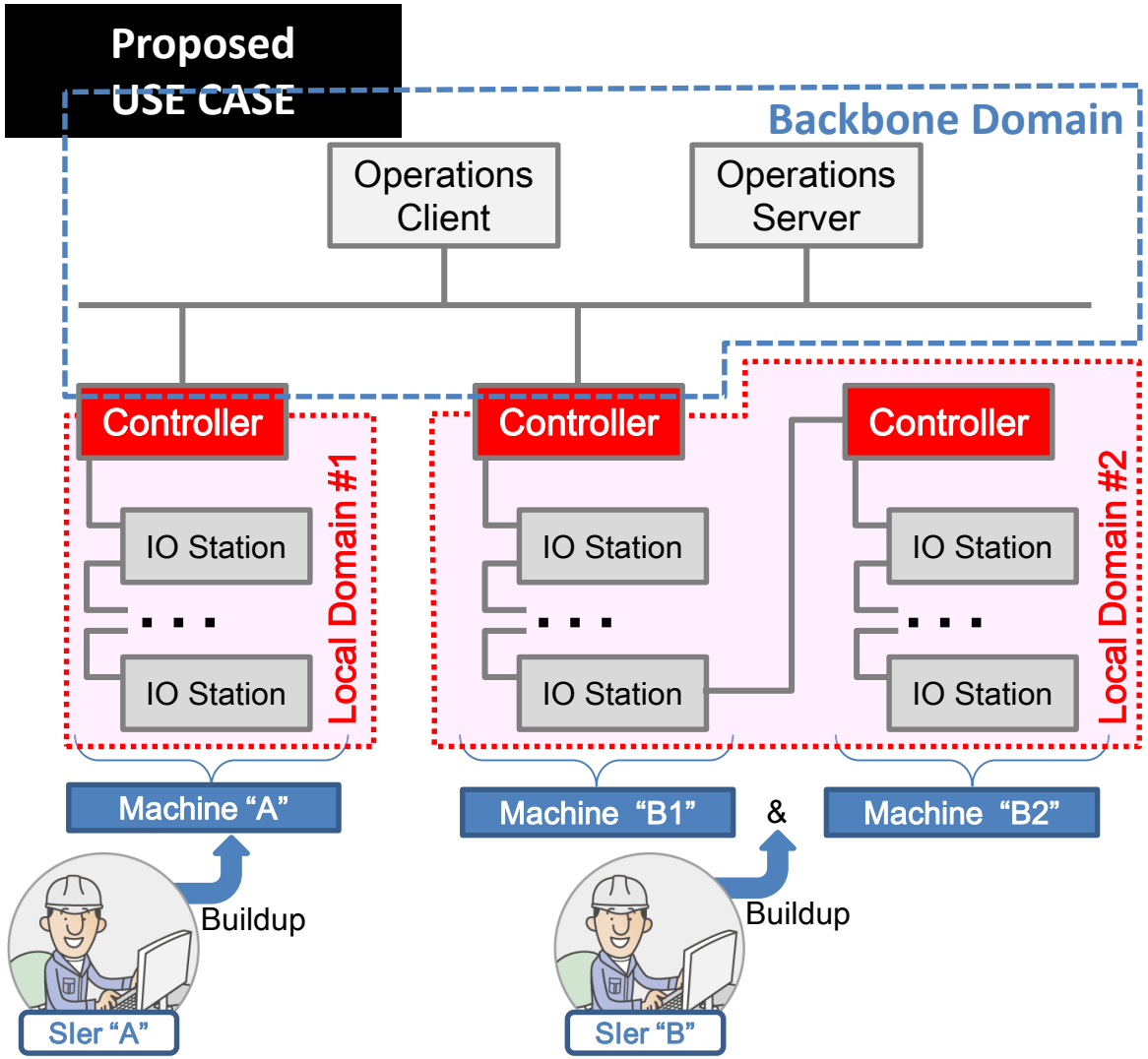
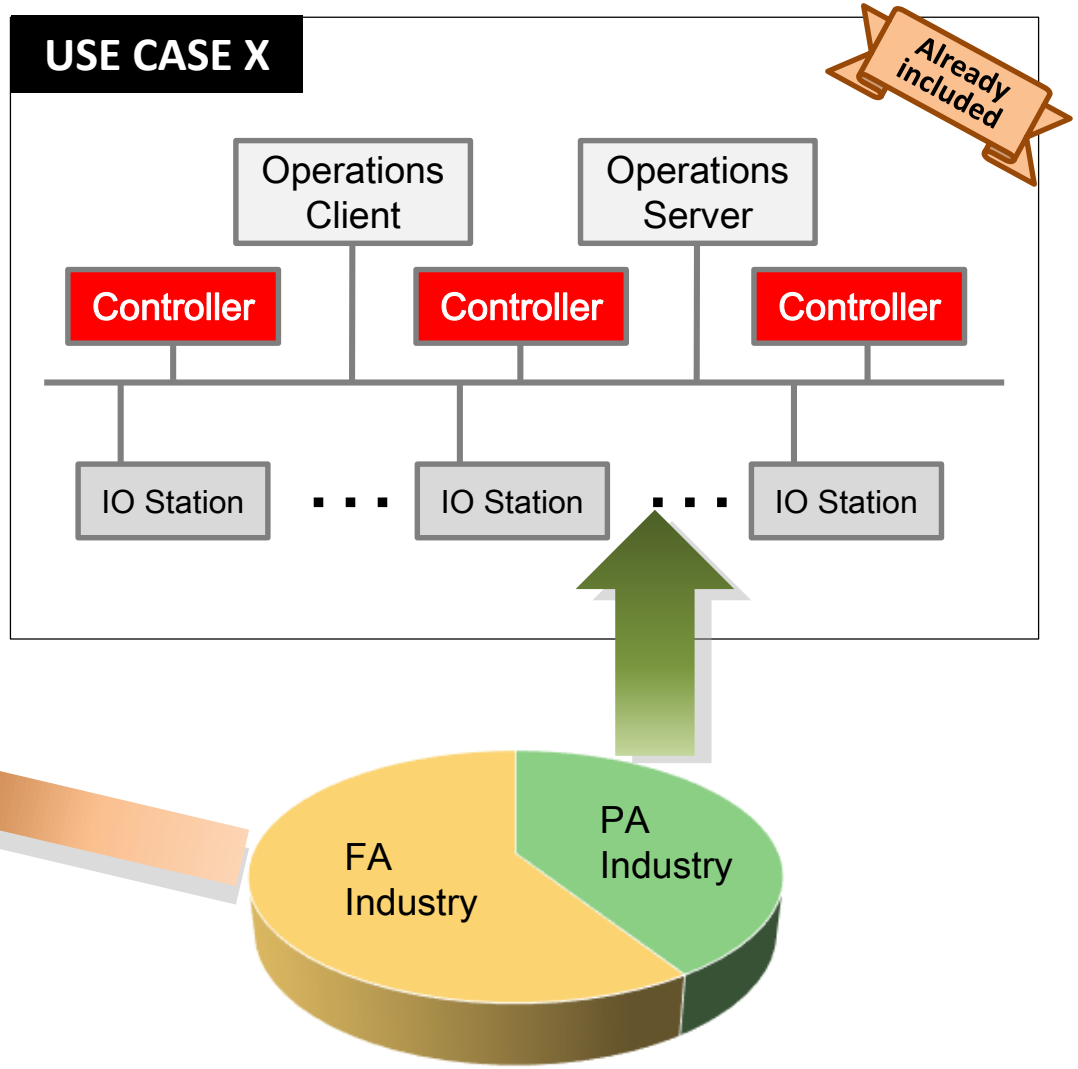
Backbone Domain

- 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.

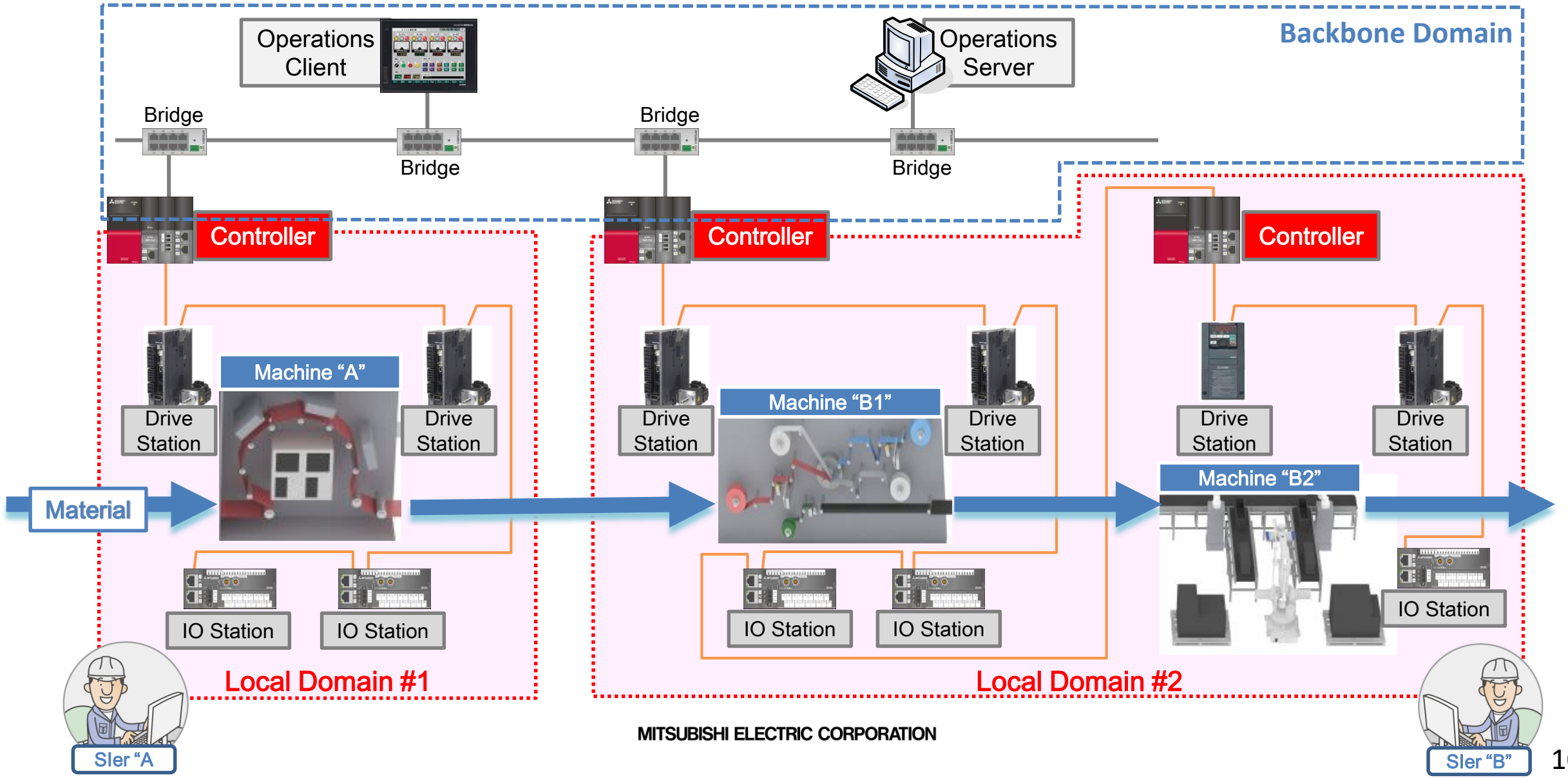
Use Case



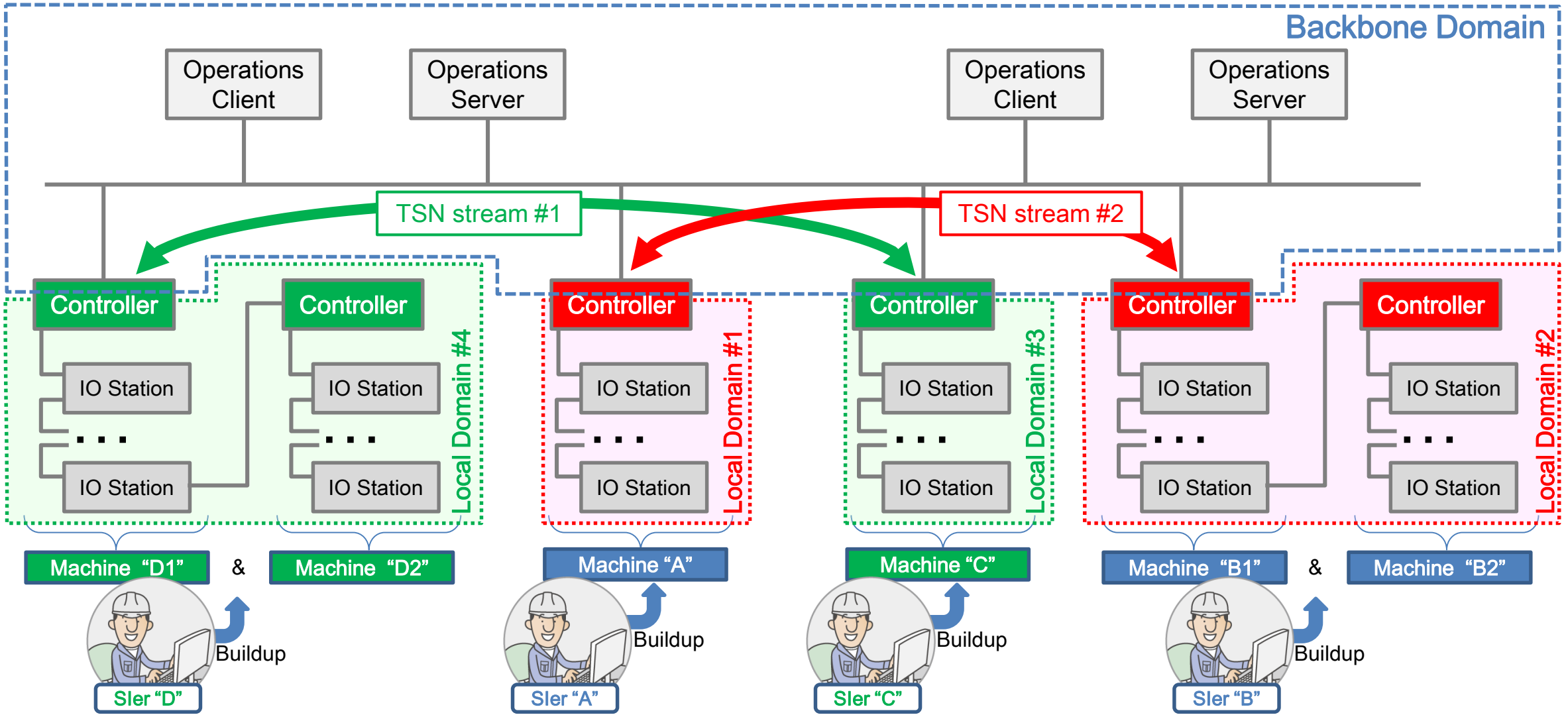


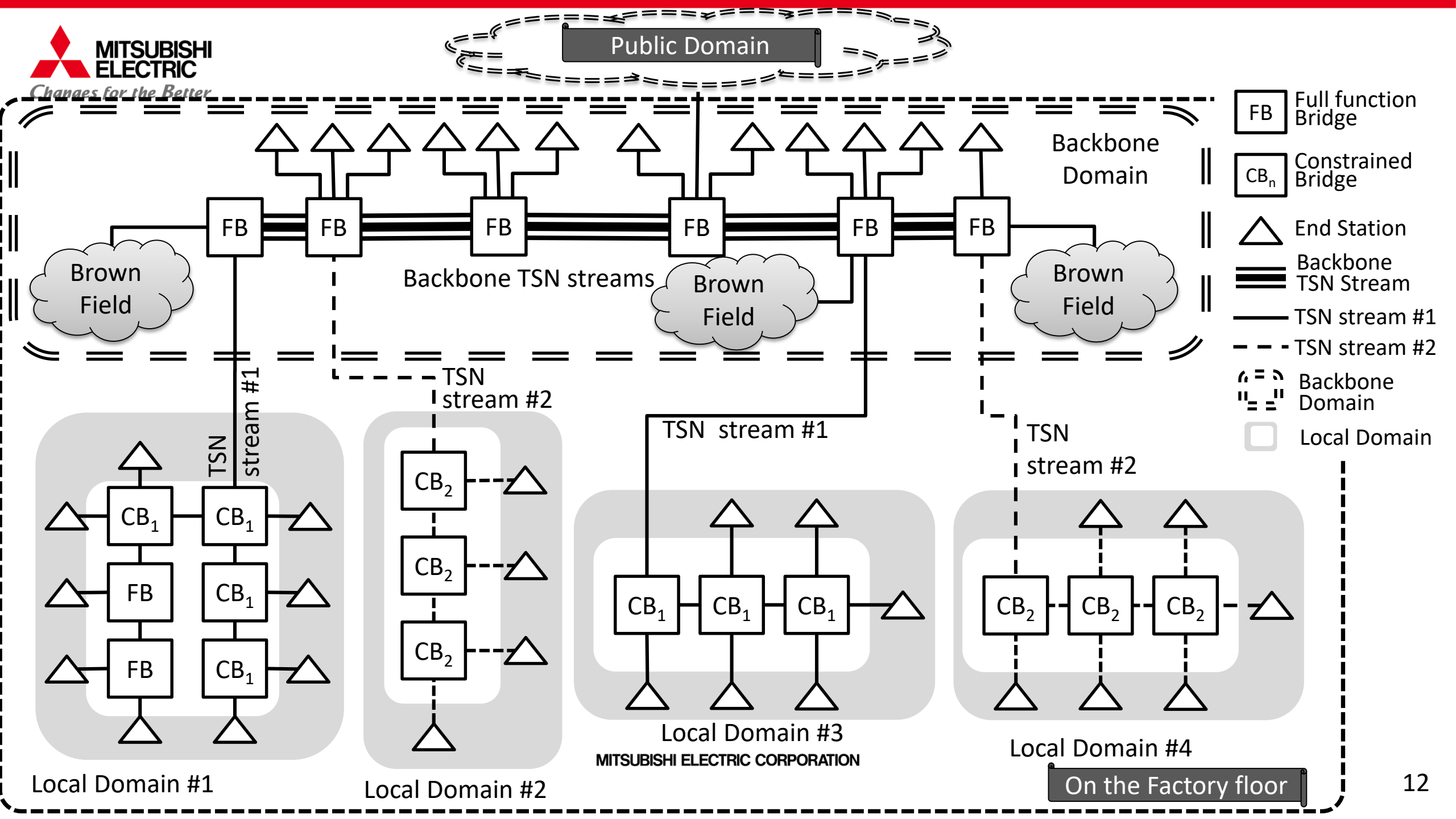
Field Network ration in Industrial field
[An assumption based on IHS Research 2016]

System Image in Use Case 1



Multi TSN streaming in Use Case 1

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Public Domain
Backbone Domain
FB
FB
FB
FB
FB
FB
Brown Field
Brown Field
Brown Field
Backbone TSN streams
TSN stream #1
TSN stream #2
TSN stream #1
TSN stream #2
CB1
CB2
Local Domain #1
Local Domain #2
Local Domain #3
Local Domain #4
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On the Factory floor
FB Full function Bridge
CBn Constrained Bridge
End Station
Backbone TSN Stream
TSN stream #1
TSN stream #2
Backbone Domain
Local Domain

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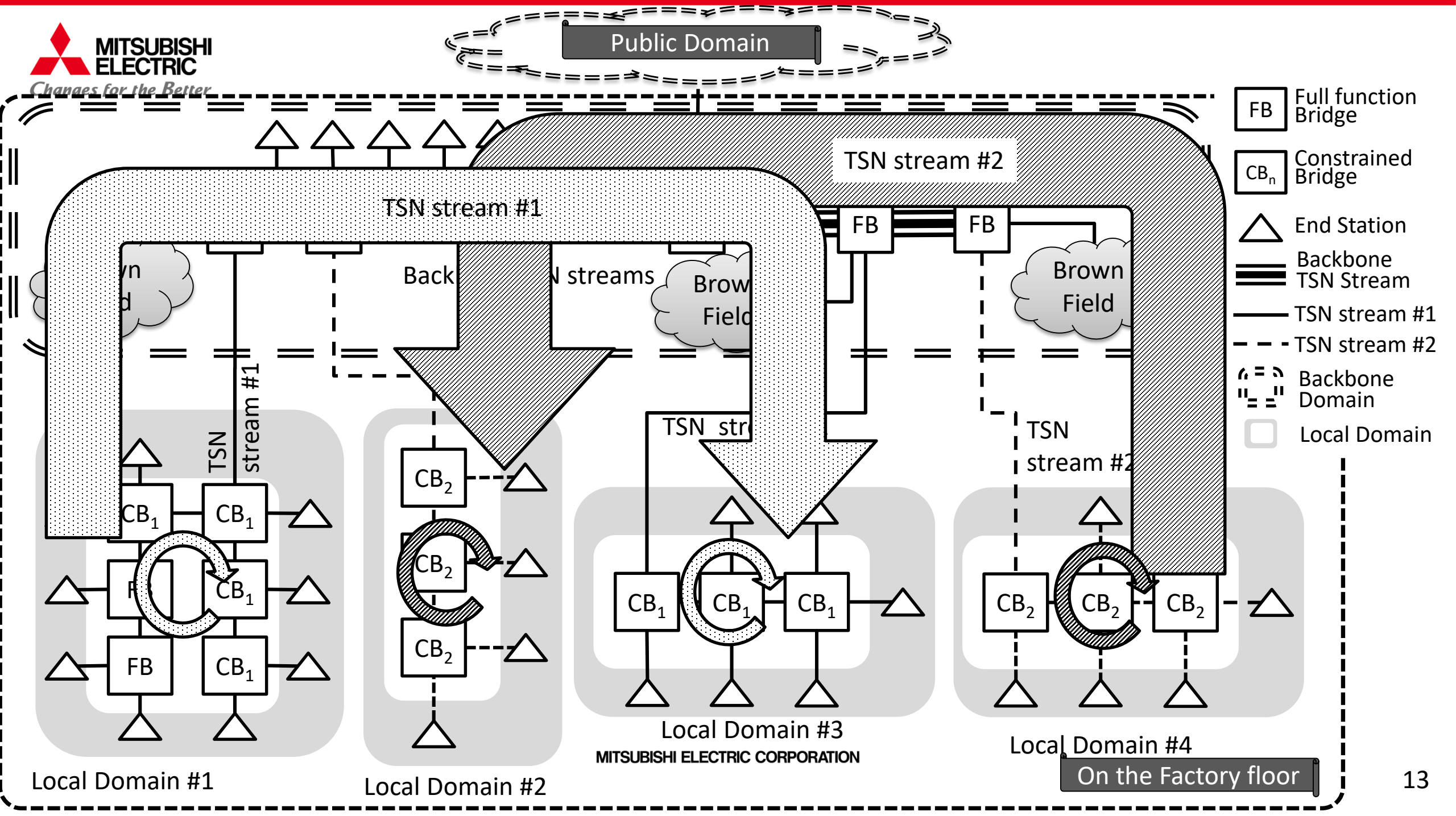

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Full function Bridge (FB)

- It shall multiplex between two and more real-time communications and non-RT communications.
- It shall support dynamic configuration.
- It shall supervise configuration and security [802.1X etc.] of traffics between Local Domains, other domains and Public Domain.

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Constrain Bridge (CB)

- It shall multiplex between one RT communication and n-RT communications, And it may multiplex between RT communications and n-RT communications.
- It shall support Predefined configuration.
- It is subset of the Full functional Bridge (FB).


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