SPIDERS Phase III

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Definition

*The **U.S. Department of Energy**'s official definition of a microgrid is "a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid [and can] connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode."*

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Purpose of SPIDERS

- More Efficient Operation of Diesel Generators
  - Supply critical load using fewer generators
  - Online generators operate at more efficient point
- Ability to Integrate Renewable Resources
  - Microgrid provides a "grid source" to allow UL compliant equipment to operate
  - Power from renewables further reduces consumption of diesel fuel
- Increased Redundancy for Critical Systems
  - Generators can serve any load in microgrid
- Implement Cyber Security for Microgrid Command and Control
  - Microgrids must be less vulnerable than the utility grid to cyber attacks
  - Control network must be responsive to rapidly changing electrical system
- Minimize Changes to Existing Infrastructure
  - In order to maximize effectiveness of SPIDERS program, it must be implemented at existing facilities – not just new ones
  - Utilizing existing infrastructure increases reliability and maintainability of systems

REDUCE DIESEL FUEL CONSUMPTION

&

INCREASE RELIABILITY

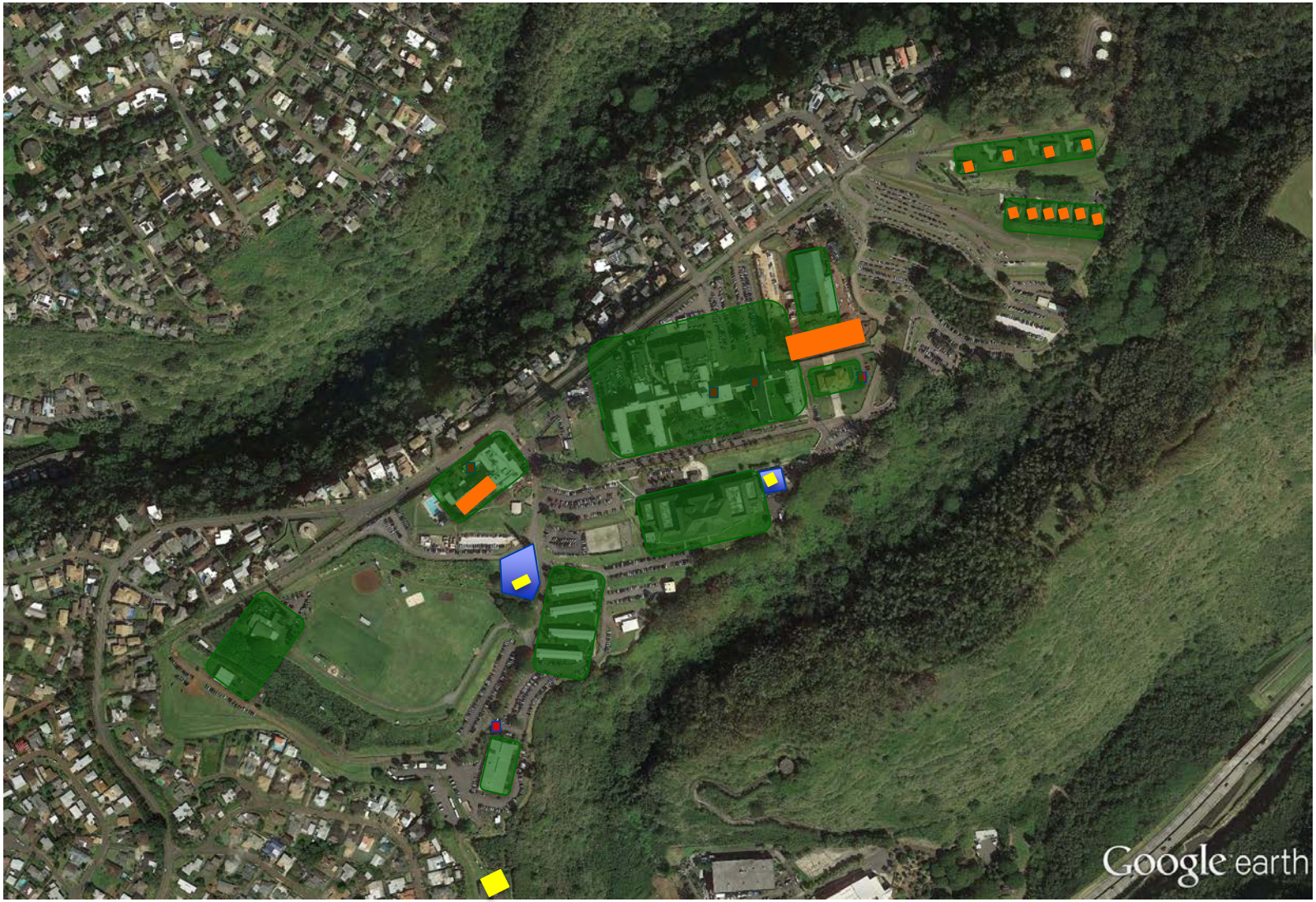
What does it do

- Multiple Microgrids Integrated into one
- Increase Effecacy of Diesel Fuel
- Contingency Operations
- Renewable integration
- Seamless Power loss

System Make Up

- Tier 4i Generation
- Existing PV arrays
- Existing Emergency Generators
- Batteries
- Controls

Phase III Microgrid

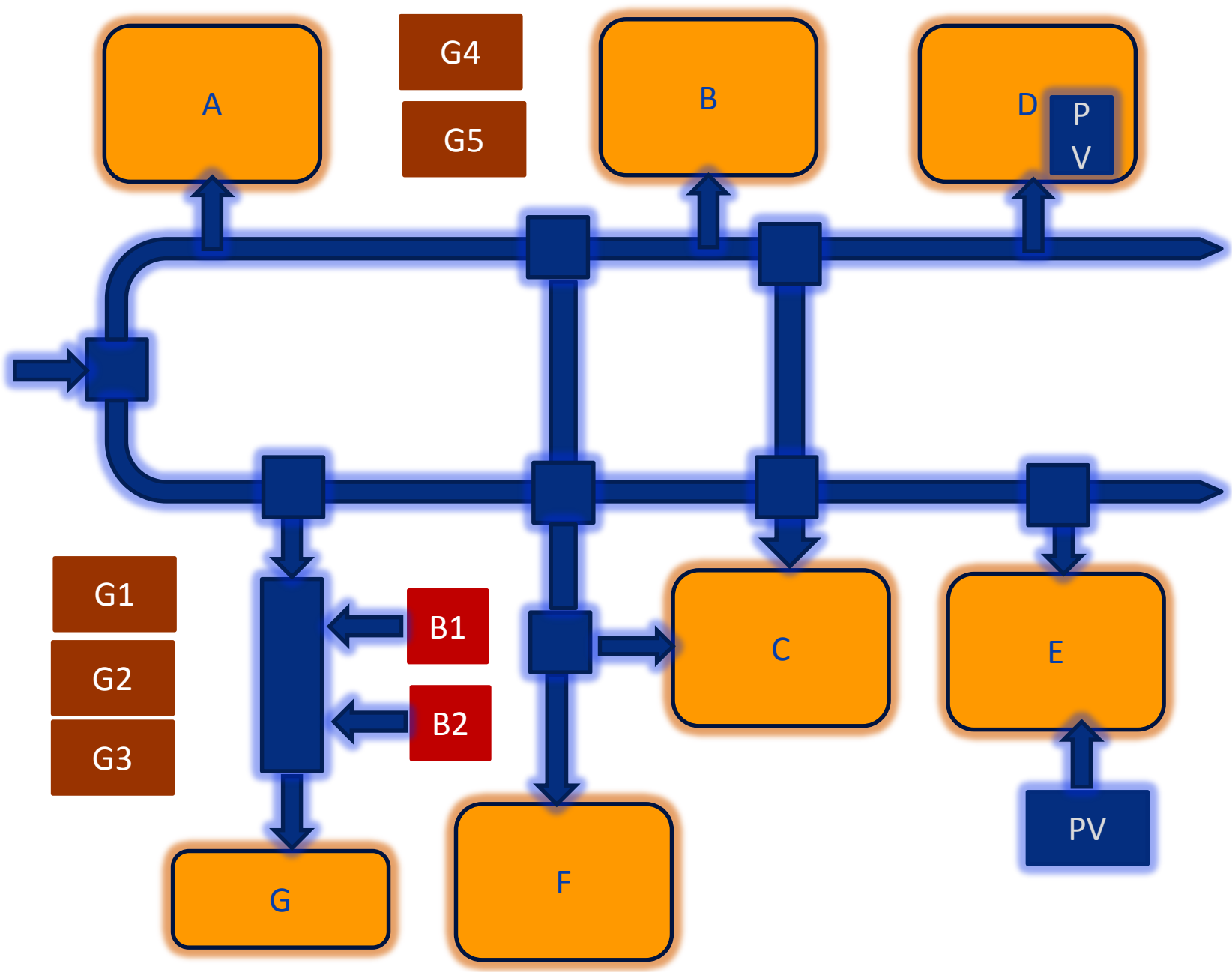


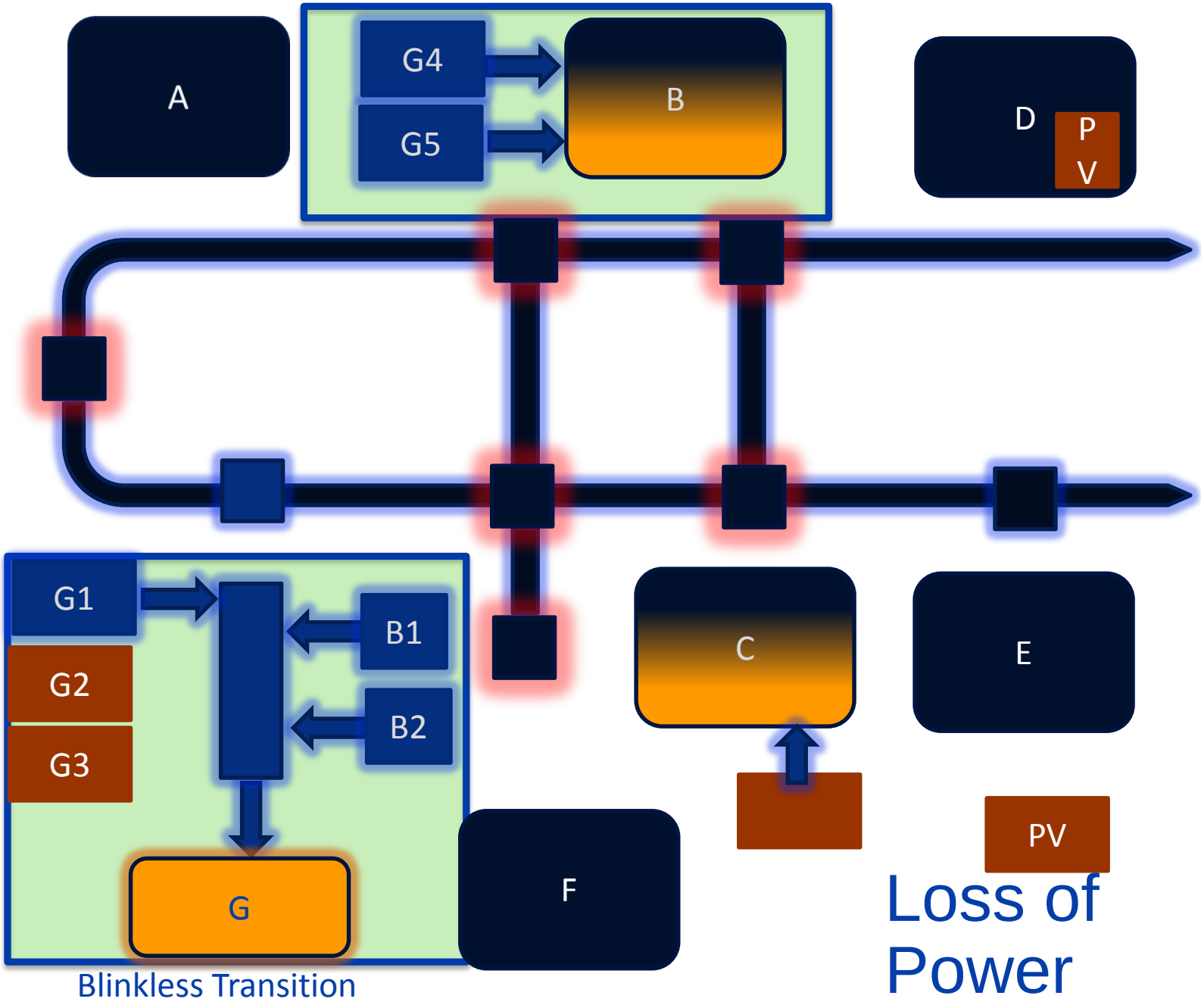
- Building
- PV Array
- Generation Site
- Coupling Points

System Operation

Conceptual System Operation

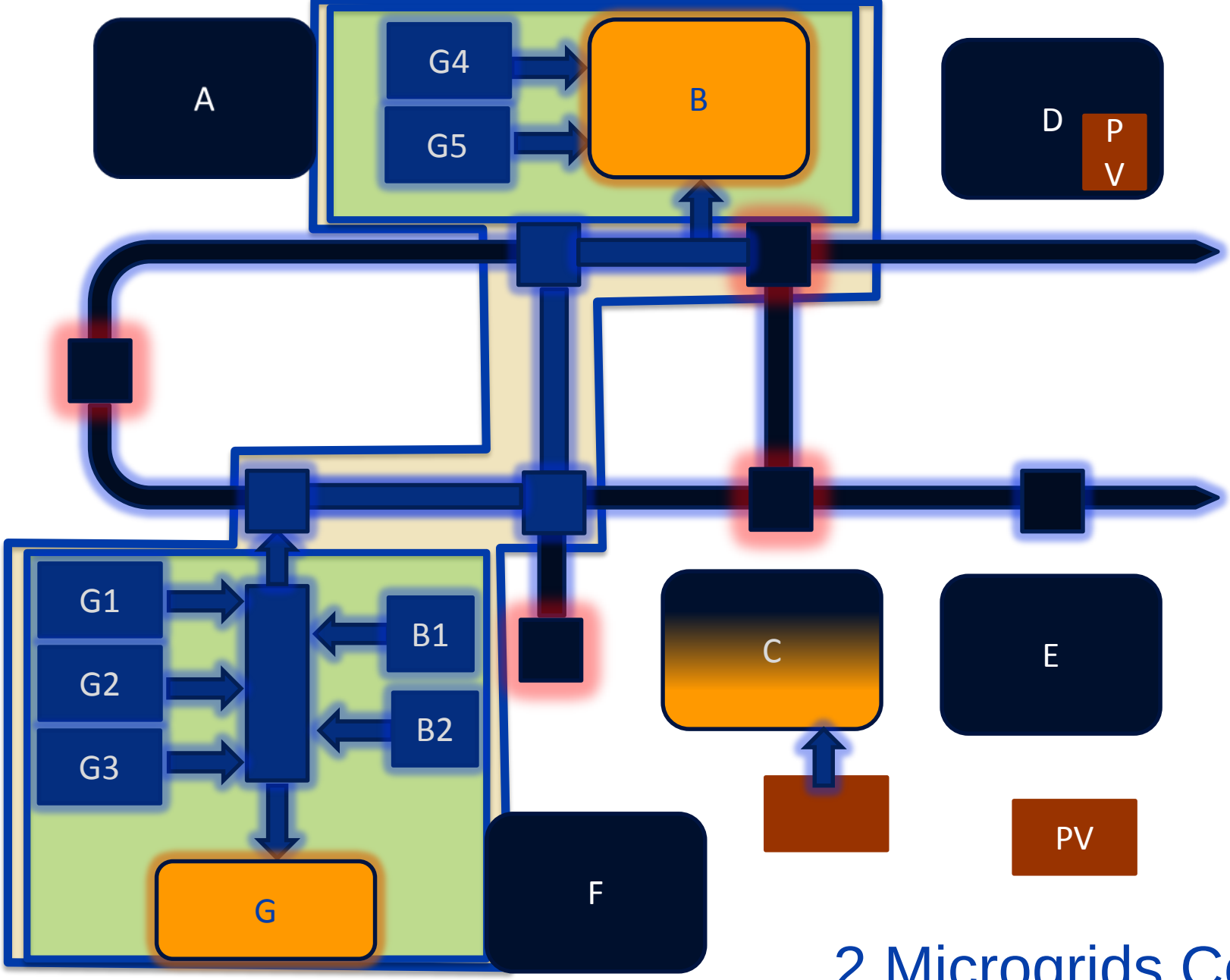
- Multiple Microgrids
- Critical Building Prioritization
  - PV Override
- Battery N+1
- Contingency = N+1 Configurations
- Cyber Security


A
G4
G5
B
D
P
V
G1
G2
G3
B1
B2
C
E
PV
G
F

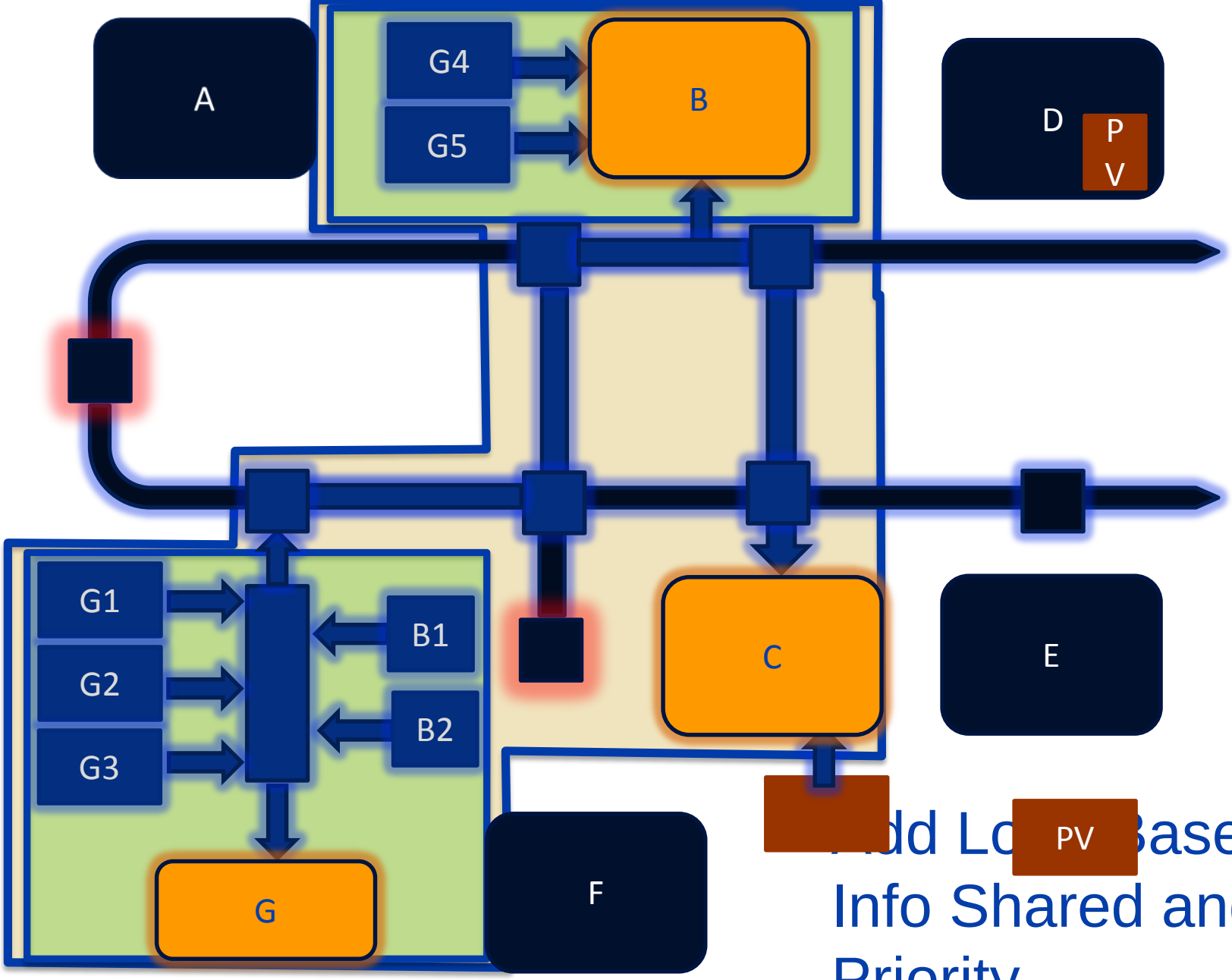


Blinkless Transition

Loss of Power



2 Microgrids Combine



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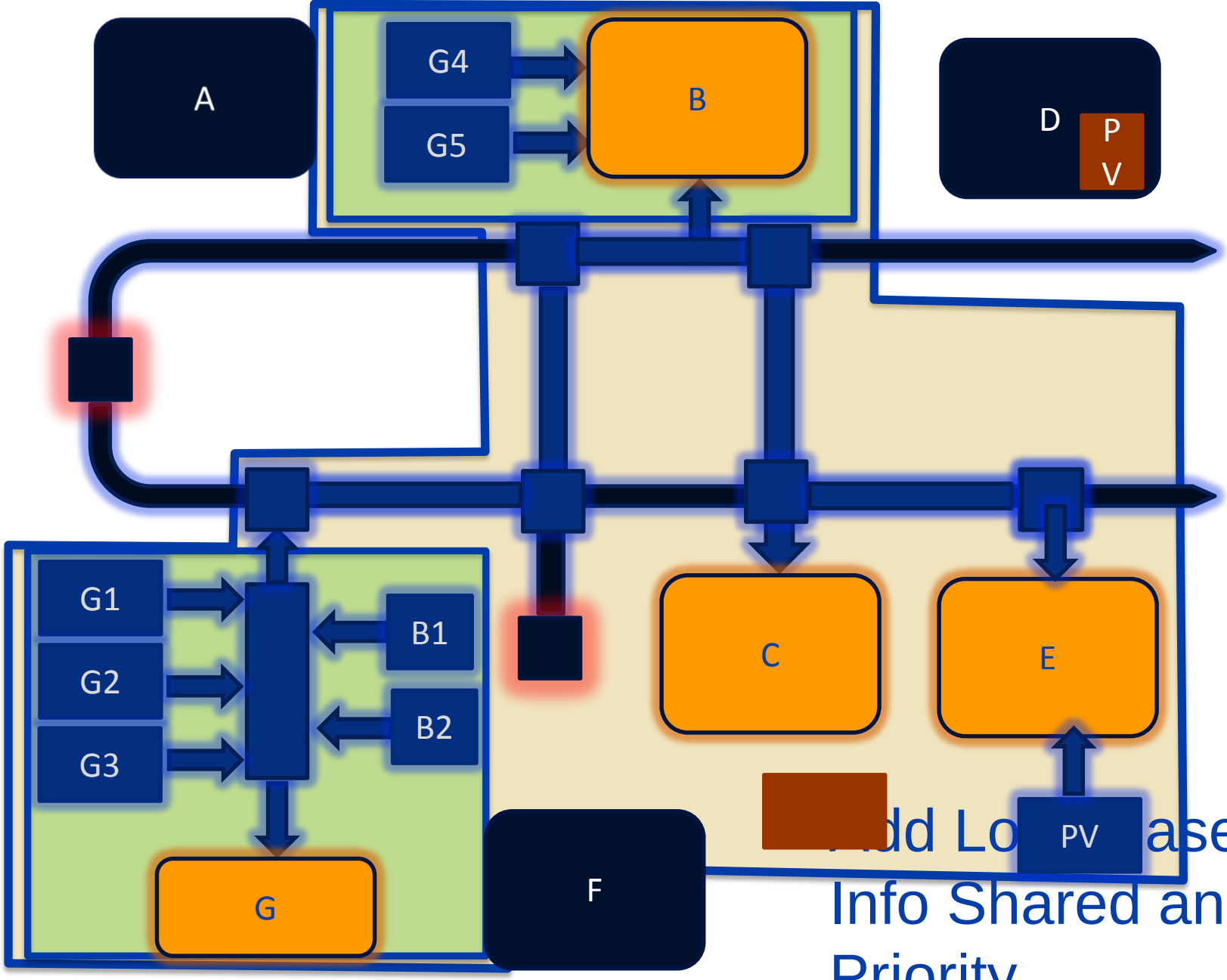

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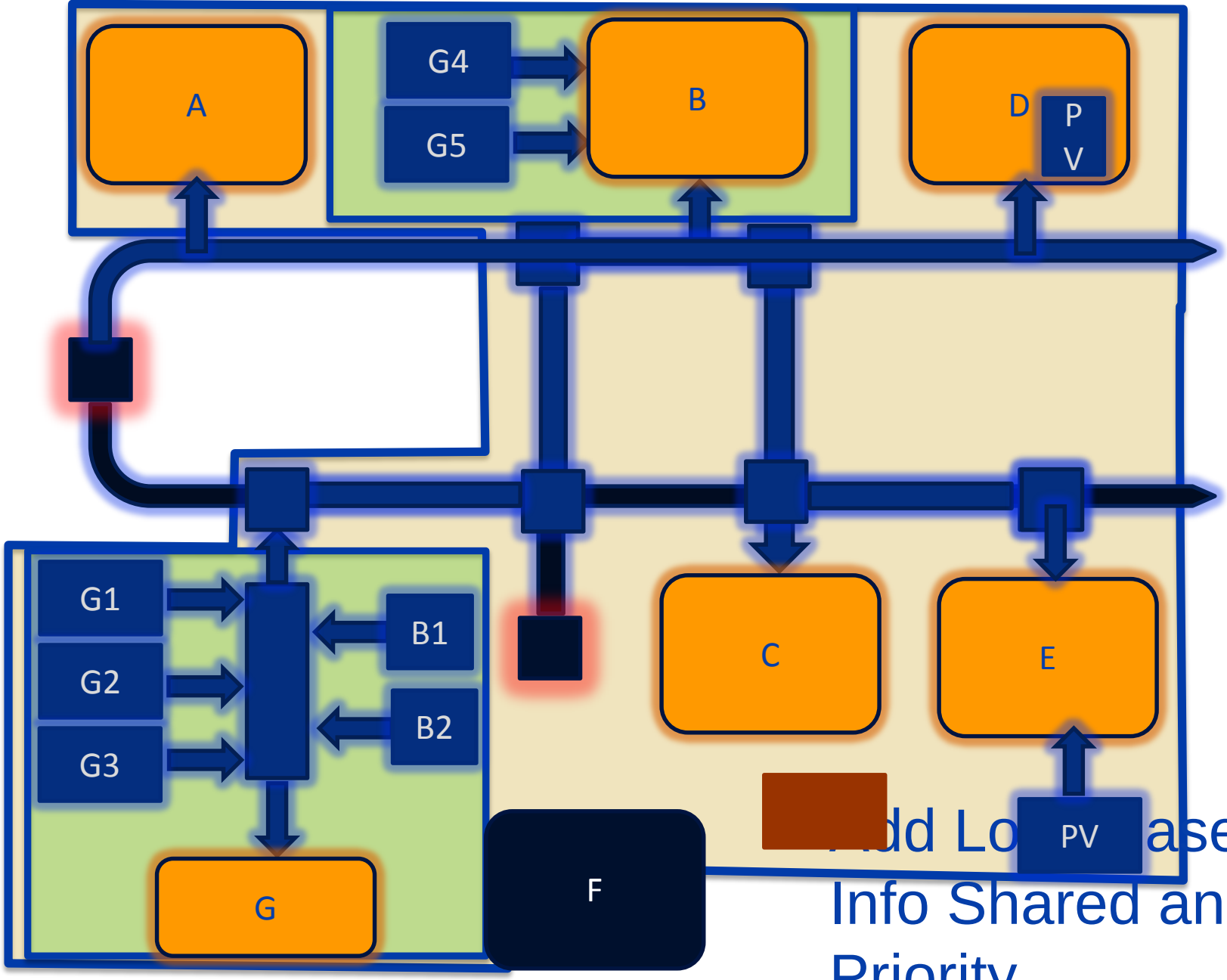

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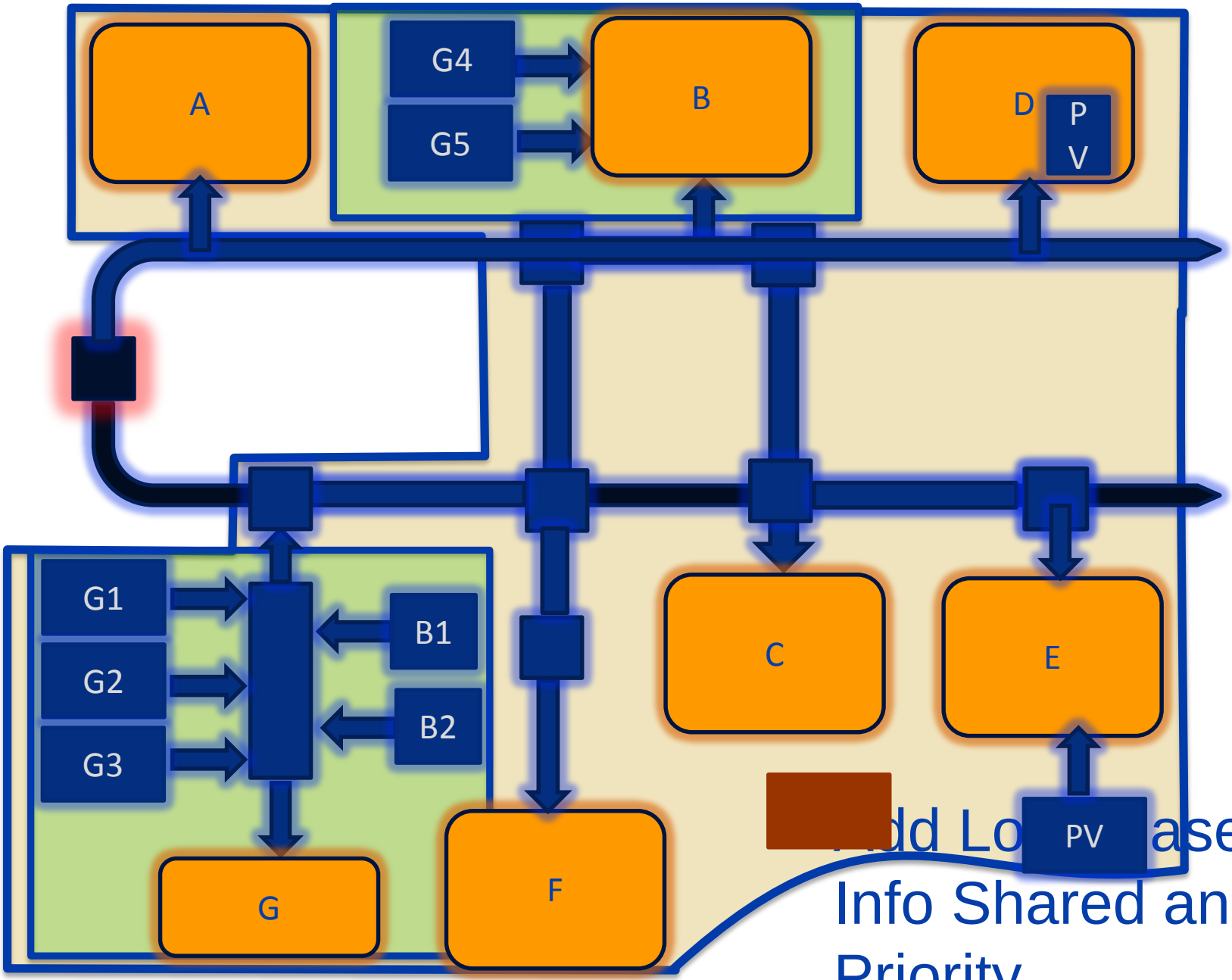

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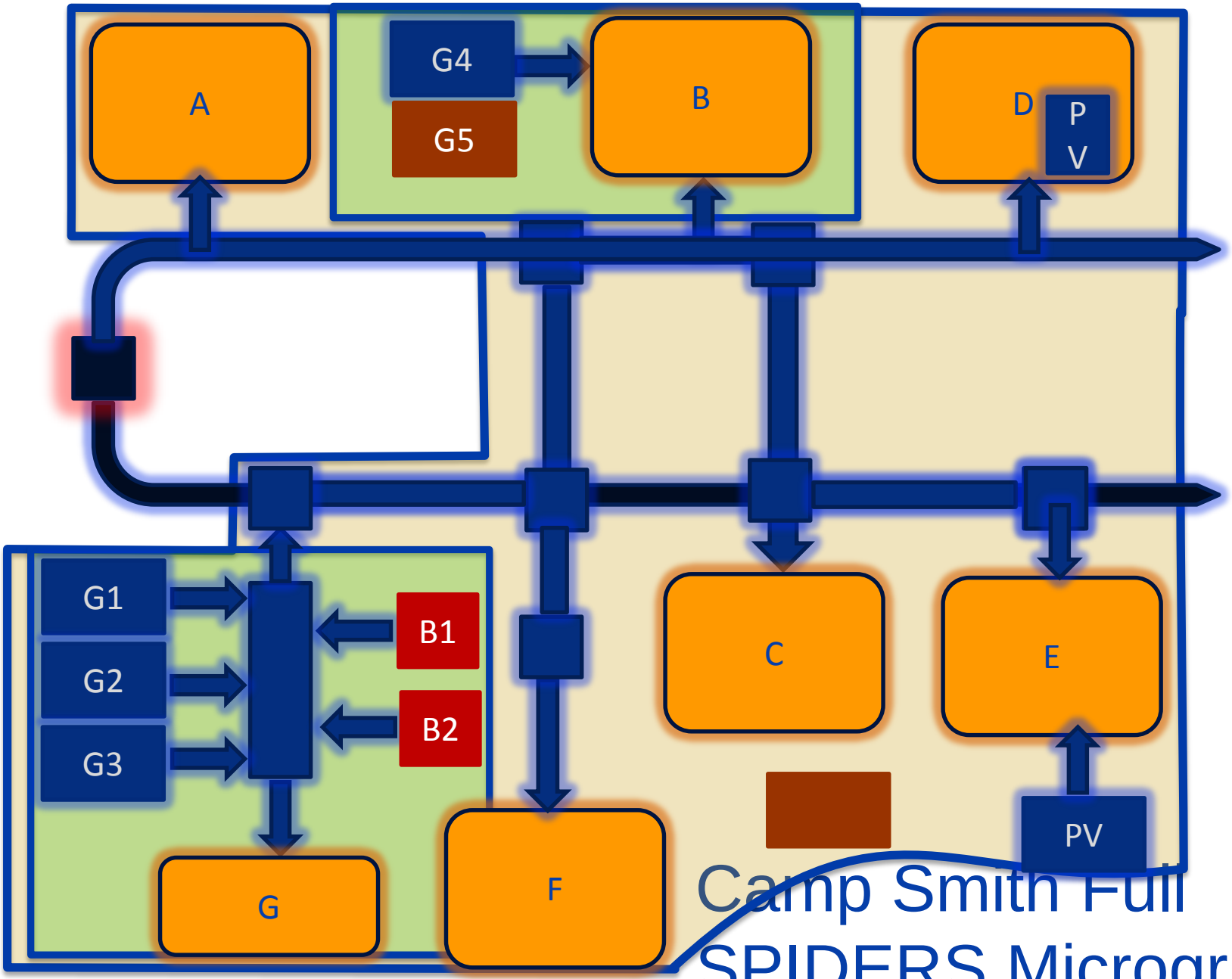
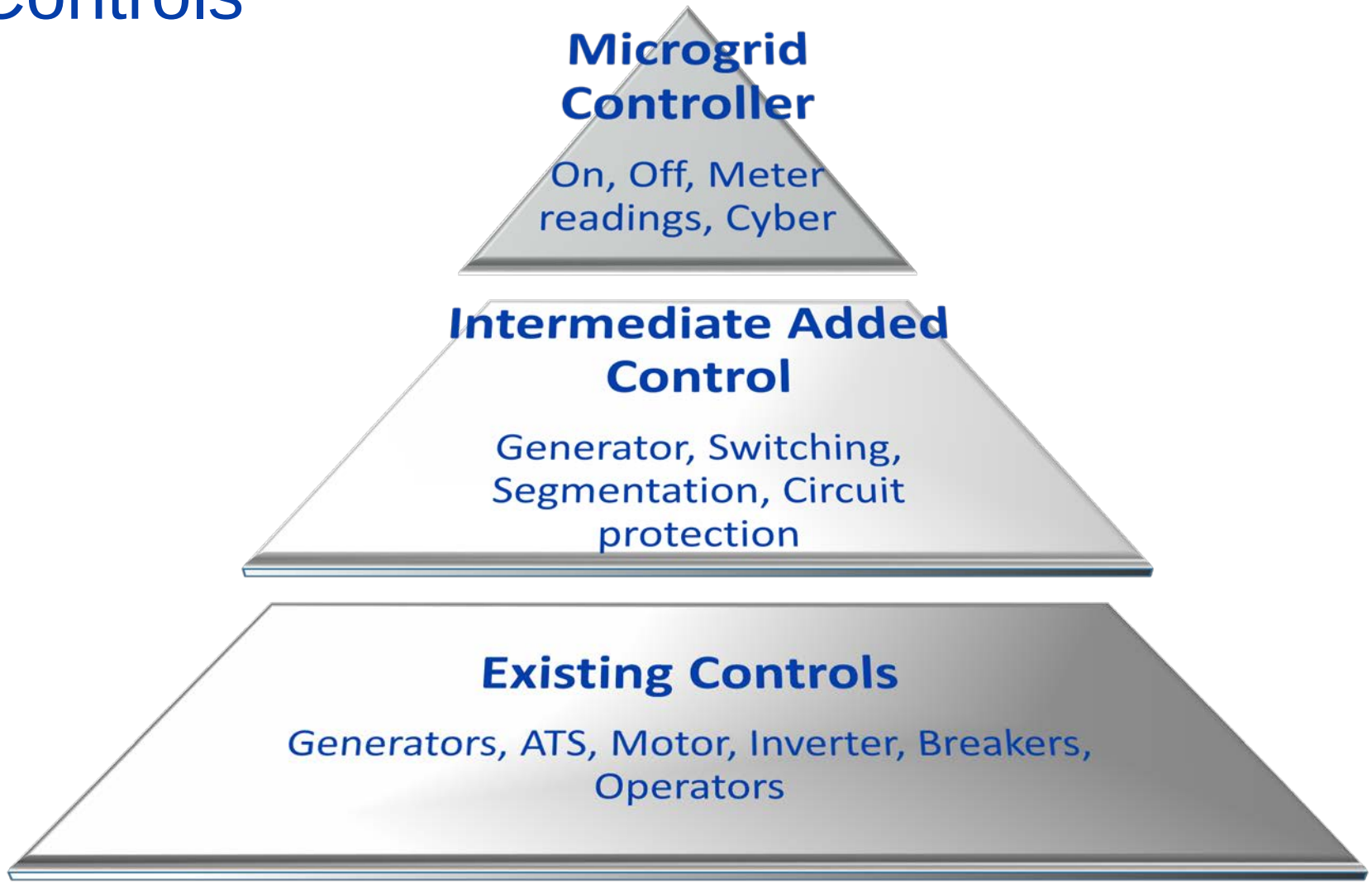
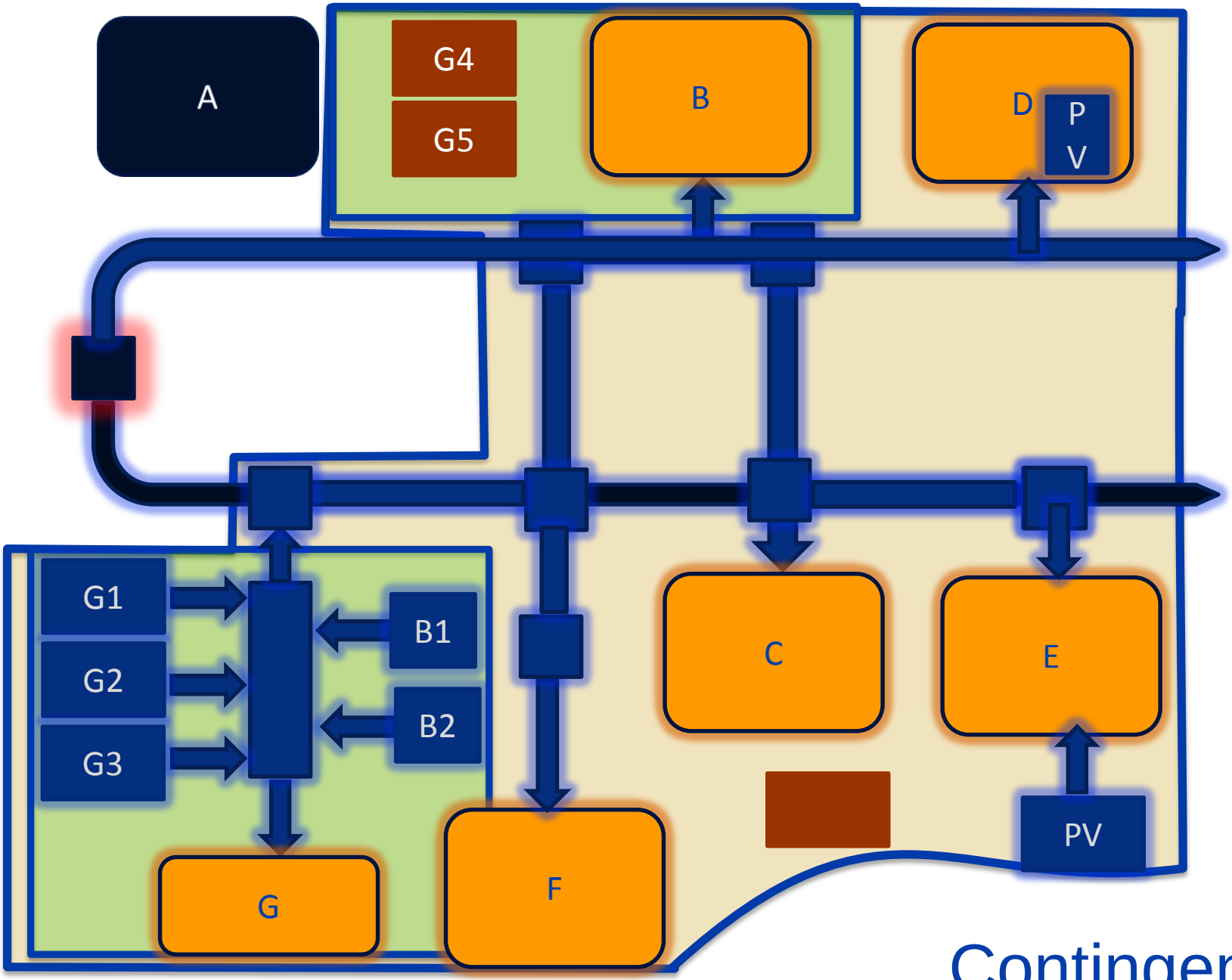
Optimize



Camp Smith Full SPIDERS Microgrid

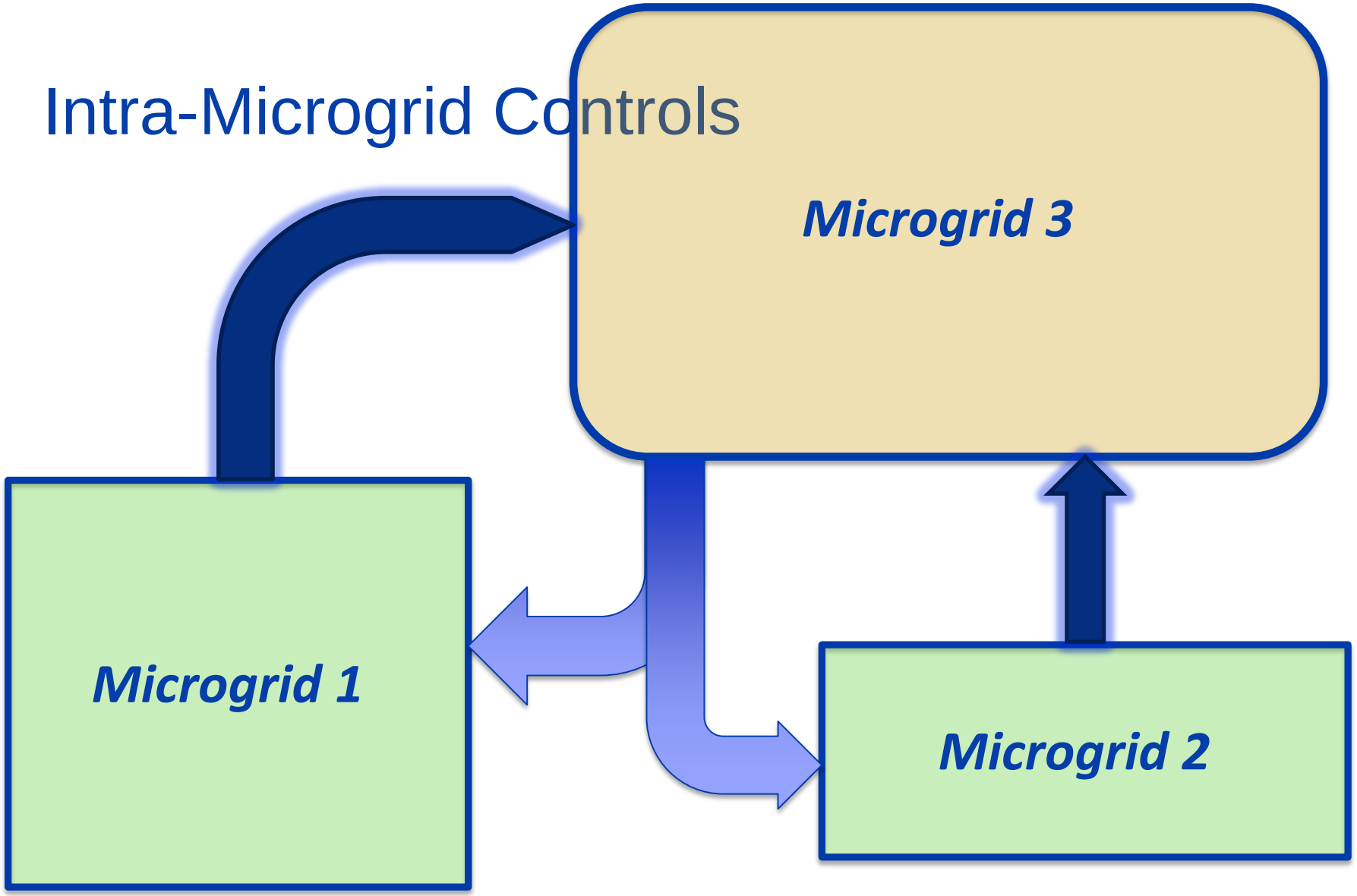
Controls


Microgrid Controller
On, Off, Meter readings, Cyber
Intermediate Added Control
Generator, Switching, Segmentation, Circuit protection
Existing Controls
Generators, ATS, Motor, Inverter, Breakers, Operators



Contingency

Intra-Microgrid Controls



Conclusion

- Complex
- Critical Building Cx
- Infrastructure is Key
- RELIABILITY

Questions