



APROL R 4.0

Redundancy in APROL



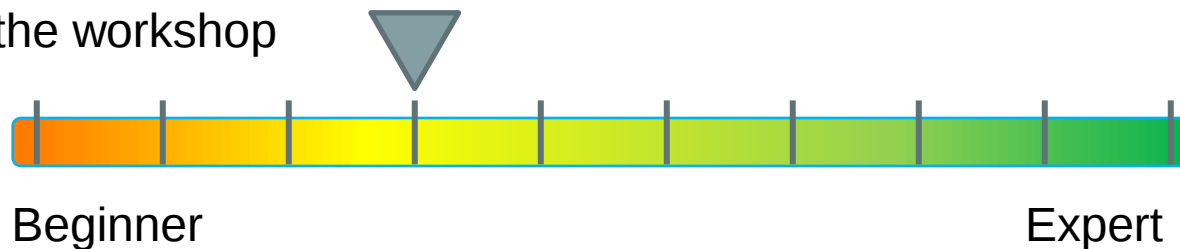
Agenda

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Time	Topic	Presenter
2h	Redundant Control Computer	Kreil
30min	Redundant Networks	Kreil
1h 30min	Multi Runtime Systems (MRS)	Schweiberer
	--- Lunch ---	
afterwards	CPU Redundancy	Schweiberer

Aimed level for the workshop





● General

● Configuration

- CaeManager
- AprotConfig

● Server-Redundancy <> Client-Redundancy

● Synchronisation

- Chronoplex

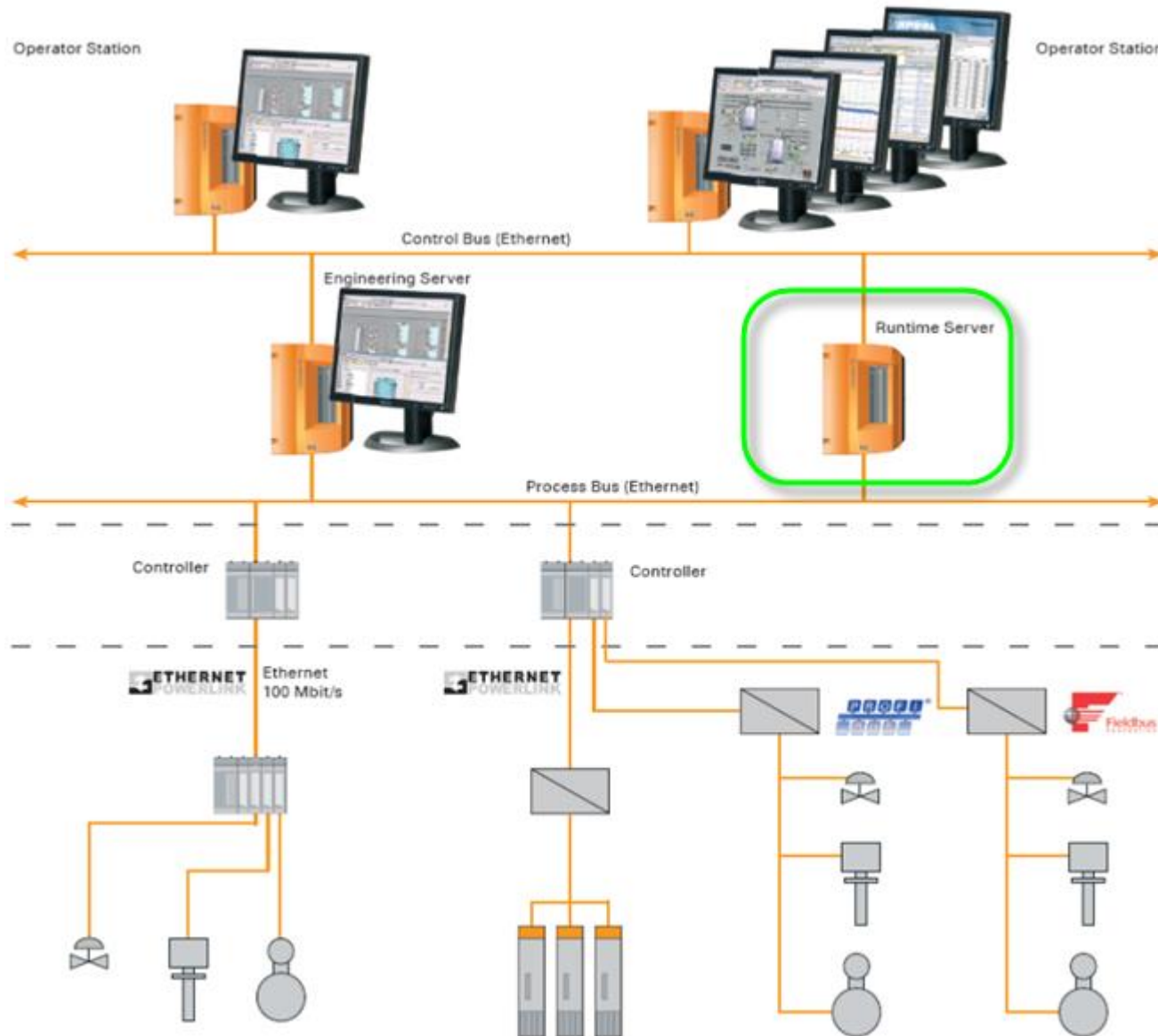


● Motivation:

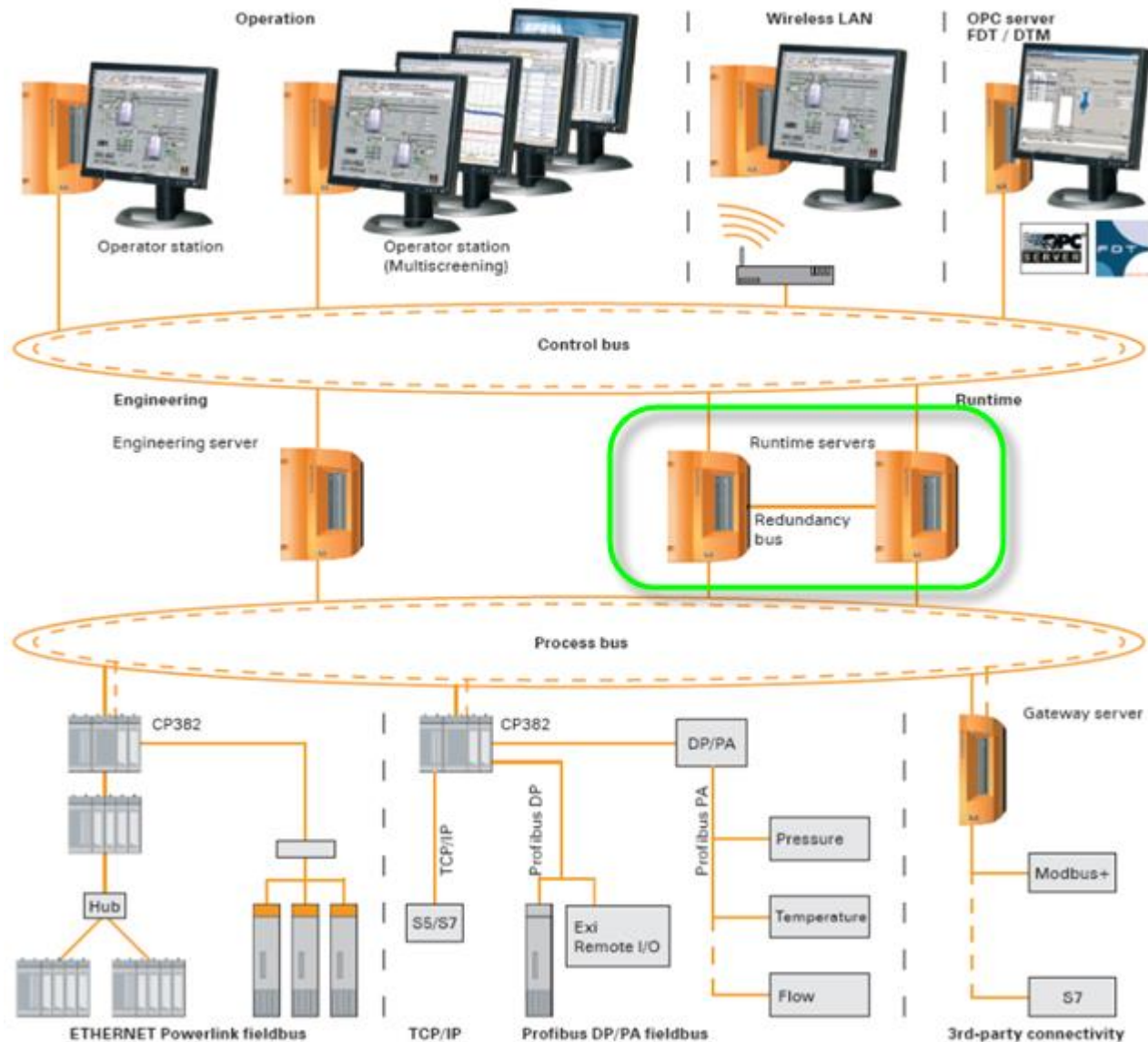
High availability of control computer functionalities

- Operating and controlling the plant
- Trends
- Alarms
- Reports

General: single runtime system



General: redundant runtime system





What do we need??

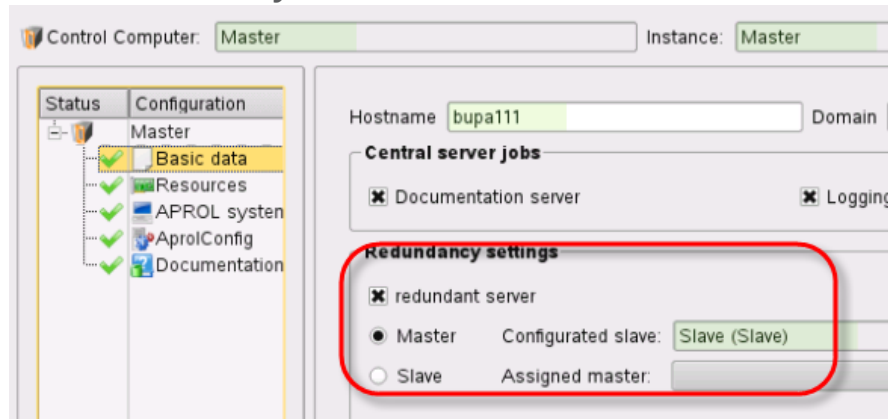
- 2 Control Computer (Master and Slave)
- 1 AprolSystem (redundant)

Runtime					049:
+	Master	● ✓		Master	049: Run
+	Slave	● ✓		Slave	049: Run
+	x20fbrun01 (default)	● ✓ ↓	●	x20fbrun	049:
					049: Ctl

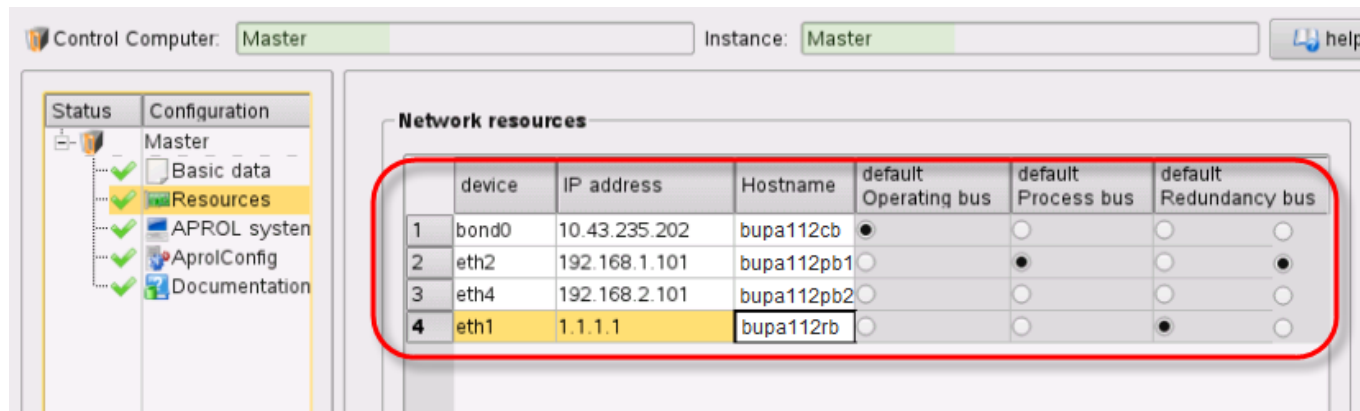


Control Computer: Master

- Select redundancy master



- Configuration of network devices





Control Computer: Slave

- Select redundancy slave and according master

Control Computer: Slave Instance: Slave

Hostname: bupa112 Domain: br-automation.co.at

Master assignment for central server jobs:

☒ Documentation server ☒ Logging server

Redundancy settings

☒ redundant server

☐ Master Configured slave:

☒ Slave Assigned master: Master (Master)

- Configuration of network devices

Control Computer: Slave Instance: Slave

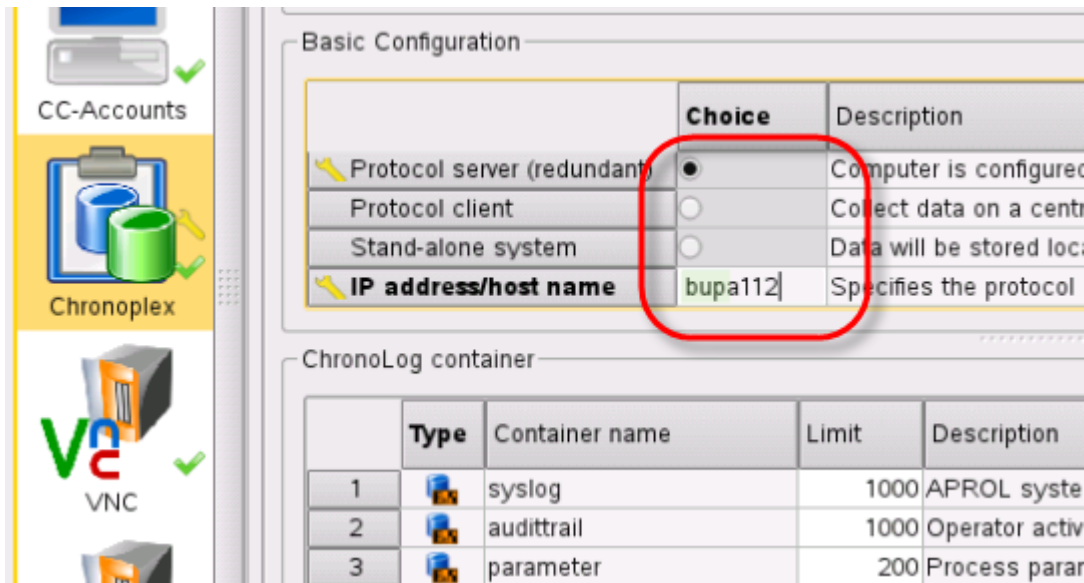
Network resources

	device	IP address	Hostname	default Operating bus	default Process bus	default Redundancy bus
1	bond0	10.43.235.203	bupa113cb	☒	☐	☐
2	eth2	192.168.1.102	bupa113pb1	☐	☒	☐
3	eth4	192.168.2.102	bupa113pb2	☐	☐	☐
4	eth3	1.1.1.2	bupa113rb	☐	☐	☒



● ArolConfig **direct** on the both systems:

- Chronoplex
 - Protocol server (redundant)
 - Configure opposite system

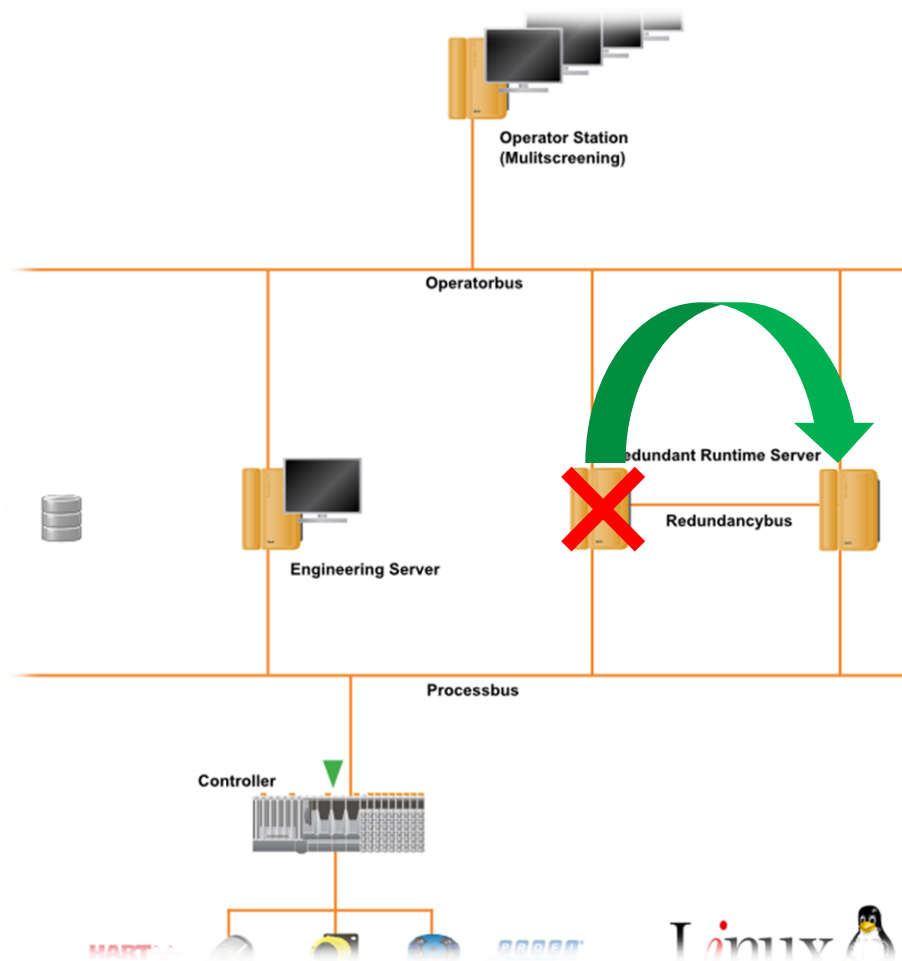


● What is Chronoplex?? Documentation: D2-2.3.4



● Slave takes complete process control if master is off

- Power fail
- ...





● Slave takes individual control of processes if necessary

- Service crashes
- Network error
- ...

StartManager (smeng@bupa207)

File View Extras Login Help

Project / Control computer / System

Cc01 (Cc01)

Runtime system (conf. master) + Operator system

APROL system name (instance): Cc01 (Cc01)

Control computer name (instance): Cc01Hw (Cc01Hw)

CC-Account@Hostname: smrun@bupa207

Runlevel/Application/Instance	State	R	A	Description
Runlevel 1				
IosDispatcher	running	●	✓	Data acquisition with foreign I
Iosys	running	●	✓	Process data basis server
Runlevel 2				
IosHttp	running	●	✓	IOSYS Http Module
SysInfo	running	●	✓	System and Self-Monitoring
Runlevel 3				
AnslDriver	running	●	✓	Linking controllers via ANSL
001	running	●	✓	Linking controllers via ANSL
003	running	●	✓	Linking controllers via ANSL
004	running	●	✓	Linking controllers via ANSL
PDA1	running	●	✓	Linking controllers via ANSL
ApchWinfo	running	●	✓	Supplies B&R APC status var
EventDriver	running	●	✓	Event-oriented data acquisitio
001	running	●	✓	Event-oriented data acquisitio
003	running	●	✓	Event-oriented data acquisitio
InaDriver	?	?	✗	Linking controllers via INA
PDA1	?	?	✗	Linking controllers via INA
LRTASK				
SmTask01	running	●	✓	SysMon Task
Task01	running	●	✓	Task 01
TaskRed	running	●	✓	Redu-Task
Runlevel 4				
Runlevel 5				
AlarmServer	running	●	✓	Alarm archiving / distribution
AlarmSpooler	lost	●	✓	Print out online alarms
ChronoLogServer	running	●	✓	Data compression log
TrendServer	running	●	✓	Trend log
UcbServer	running	●	✓	Event-controlled external func
001	running	●	✓	
X applications				



Operator- and Redundancybus

- connection of multiple interfaces via bonding

Name	IP Address	Device	Note
82541PI Gigabit Ethernet Controller	192.168.1.101	eth2	
82541PI Gigabit Ethernet Controller	192.168.2.101	eth4	
82573EL Gigabit Ethernet Controller (Copper)	1.1.1.1	eth1	
Bond Network	10.43.235.202	bond0	
82573L Gigabit Ethernet Controller	NONE	eth3	enslaved in bond0
RTL8111/8168B PCI Express Gigabit Ethernet controller	NONE	eth0	enslaved in bond0

Processbus

- InaDriver is able to handle 2 parallel connections
- AnslDriver is be able to handle bonding (Automation Runtime 4.23)

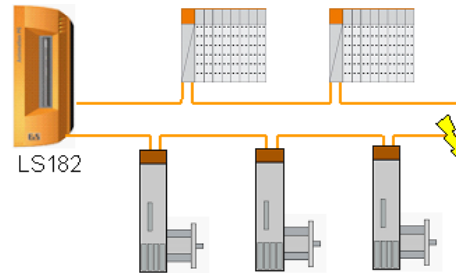
Group / Application / Instance	Status	Start	Autostart	Restart	Description
Management	✓				Central management
System services	✓				Required APROL sys
Driver	✓				Communication with
AnslDriver	✓				Linking controllers vi
dcsDriver	✓				DCS2000 link
dcsEventDriver	✓				Migration to DCS200
Dispatcher	✓				Multiplex and Demult
EventDriver	✓				Event-oriented data a
InaDriver	✓				Linking controllers vi
01 (CTRL001)	✓	1	5	5	049: CP320
02 (CTRL002)	✓	1	5	5	049: CP340
03 (CTRL003)	✓	1	5	5	049: CP360
04 (CTRL004)	✓	1	5	5	049: CP380

Application	Prio	Category	Option	Value	Used
naDriver_01	1	Connectivity	srcNodeSlave	186	X
naDriver_01	1	Connectivity	srcNode	185	X
naDriver_01	1	Connectivity	routeSecondary		-
naDriver_01	1	Connectivity	routePrimary		-
naDriver_01	1	Configuration	pda		-
naDriver_01	1	Mode	namedMode		X
naDriver_01	1	Connectivity	medium		X
naDriver_01	1	Connectivity	ipPrimary		X
naDriver_01	1	Connectivity	inaPortPrimary		X
naDriver_01	1	Configuration	gw		-
naDriver_01	1	Configuration	ctrlInstance		-

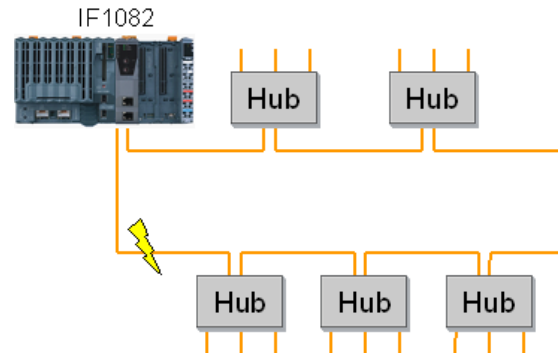


● POWERLINK

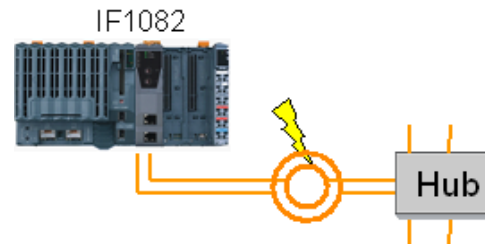
- Devices direct in a ring



- Central ring with hubs

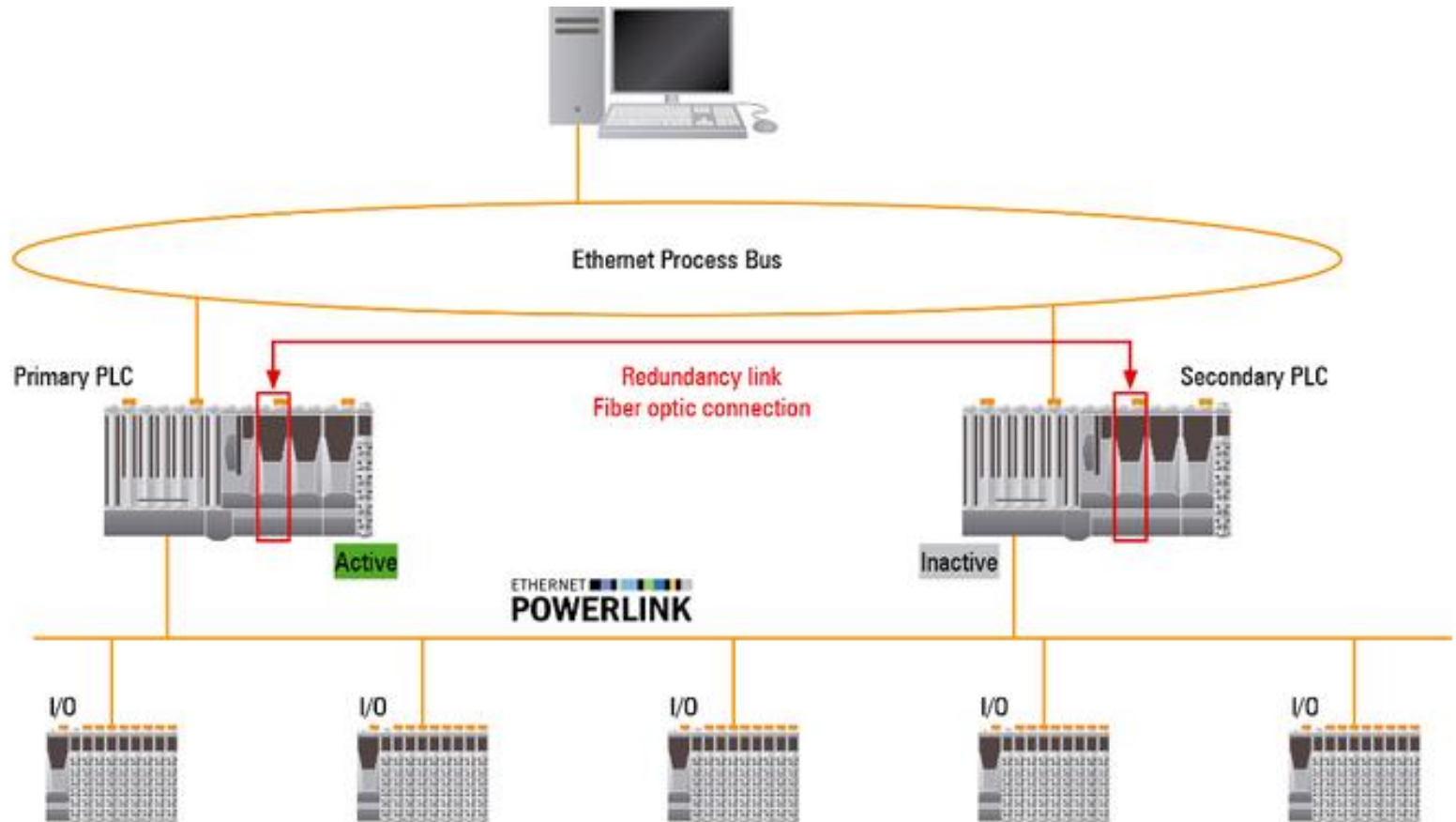


- Slip ring





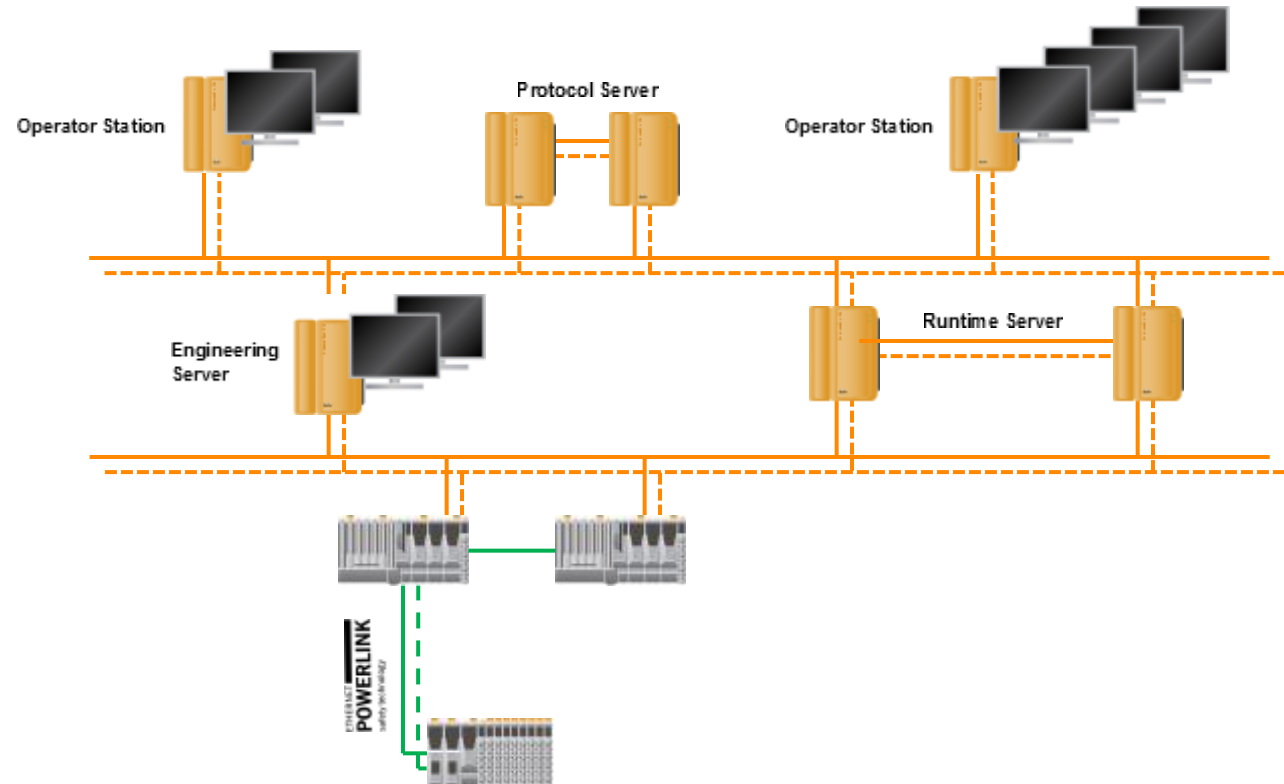
>> Afternoon



Redundancy at all levels



- ControlComputer
- Protocol server (Infos by Schweiberer)
- Controller
- Cable
 - Controlbus
 - Redundancybus (at CC)
 - Processbus
 - Powerlink





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