

Industrial and Optical Ethernet Solutions



LCSI

X-Ring Guide

Read through this guide and you will fully catch up how to configure X-Ring

Importance of Network Redundancy for Industrial Network

- In an industrial network, downtime is measured in terms of the cost per minute of lost production. For this reason, deploying an Industrial Ethernet Switch with effective network redundancy strategies is crucial in industrial applications where a failure could result in catastrophe
- Other than implementation of industrial standard STP and RSTP in LCSI industrial managed Ethernet switch; LCSI's proprietary X-Ring is designed for mission-critical industrial networks for recovery time at 20ms. X-Ring can deactivate one of the links in the ring to data traffic while simultaneously monitoring that the link is functioning. In case one of the links in the ring fails, the deactivated link will be "activated" within milliseconds

Number of Switches	30	40	50
X-Ring Recovery Time	10ms	15ms	20ms

Q/A : How many switches can be formed a ring? It is based on a IP segment (IPV4 Rule) so the answer is 254(256 -2)

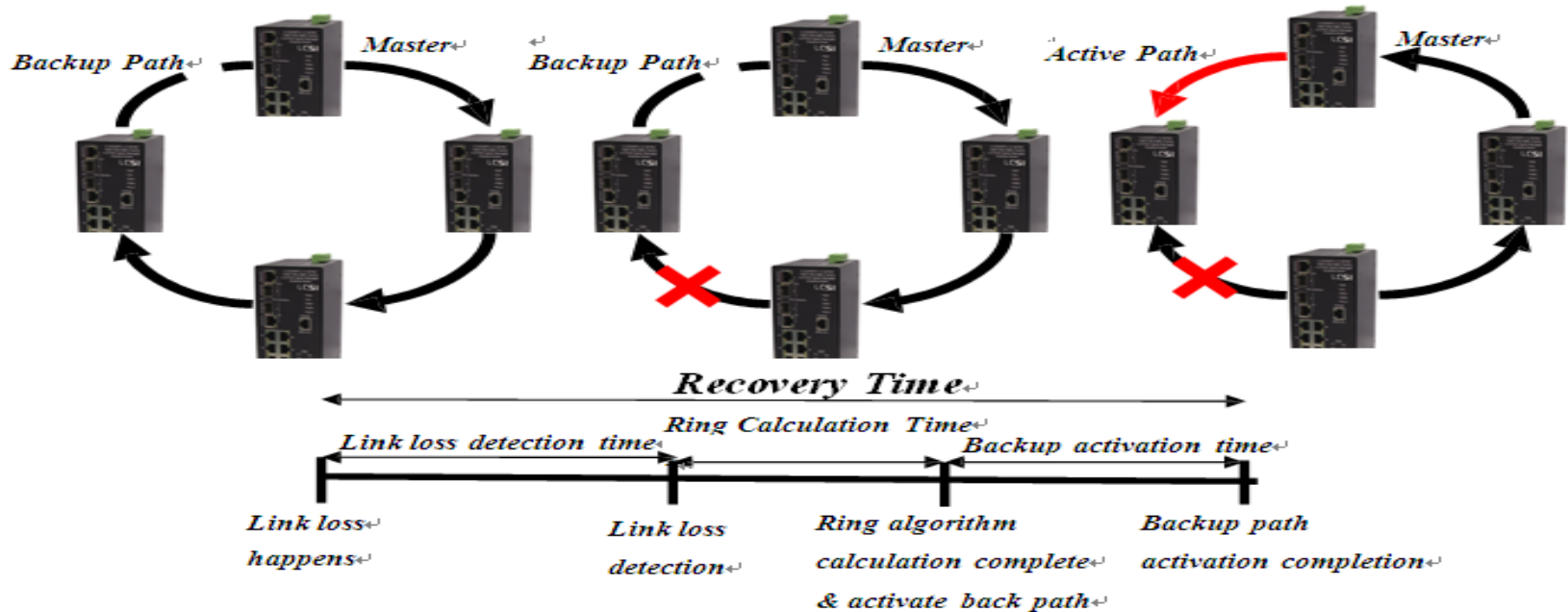
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Network Redundancy

- Network redundant recovery time is critical when having a failure in the communication link. Longer recovery time may result in serious impact to business. IEEE published two protocols: **Spanning tree protocol (STP) (IEEE 802.1D)** and **Rapid spanning tree protocol (RSTP)(IEEE 802.1w)**. However, STP(10 to 50 sec) and RSTP(3 to 5) have recovery time longer than 3 seconds, which are not acceptable in application of industrial automation, transportation automation, video surveillance, and some critical needs. Therefore, in addition to standard features of STP and RSTP, LCSI industrial managed switches also implement proprietary X-Ring protocol optimizing the network redundancy with a much faster recovery time less than 20ms.

Recovery Time = Link loss detection time + Ring Calculation Time + Backup active time.



- **Link loss detection time:** From link loss to CPU awareness. CPU must know that the link loss event happens while the link fault happens. CPU can know the event from the physical layer notification event. The CPU can also send a detection packet to detect a link loss event.
- **Ring calculation time:** From CPU awareness of loss event to ring algorithm calculation completion. A different ring algorithm will take different time to calculate new topology; the more nodes in the ring, the more time needed.
- **Backup active time:** From ring algorithm calculation completion to new topology establishment completion. After the CPU calculates ring topology, new topology needs to be established. It takes more time with complex topology.

Introduction to X-Ring Concept

Please do read this concept before reading sample configuration .
As long as you understand X-Ring concept and definition, it would be very easy to go through sample setup. To set up X-Ring only require basic TCP/IP and Ethernet Switch knowledge

X-Ring

(Note 1)

- In the X-Ring topology, every switch should be enabled with X-Ring function and two ports should be assigned as the member ports in the ring.
- Only one switch in the X-Ring group would be set as the master switch that one of its two member ports would be blocked, called backup port, and another port is called working port.
 - The ring master can negotiate and place command to other switches in the X-Ring group
 - Manually set one switch to be master switch by web management.
 - If there are 2 or more switches in master mode, the software will select the switch with lowest MAC address number as the ring master.
 - the user can identify whether the switch is the ring master by checking the R.M. LED indicator on the panel of the switch.
- Other switches in the X-Ring group are called working switches and their two member ports are called working ports. When the failure of network connection occurs, the backup port of the master switch (Ring Master) will automatically become a working port to recover from the failure

X-Ring

(Note 2)

- The system also supports the **Couple Ring** that can connect 2 * X-Ring group for the redundant backup function; **Dual Homing** function that can prevent connection lose between X-Ring group and upper level/core switch. Apart from the advantages, **Central Ring** can handle up to 4 rings(Dual Ring only 2) in the system and has the ability to recover from failure within 20 milliseconds.
 - **Enable Ring:** To enable the X-Ring function, tick the checkbox beside the **Enable Ring** string label. If this checkbox is not ticked, all the ring functions are unavailable.
 - **Enable Ring Master:** Tick the checkbox to enable this switch to be the ring master.
 - **1st & 2nd Ring Ports:** Pull down the selection menu to assign the ports as the member ports. **1st Ring Port** is the working port and **2nd Ring Port** is the backup port. When **1st Ring Port** fails, the system will automatically upgrade the **2nd Ring Port** to be the working port.

X-Ring

(Note 3)

- **Enable Couple Ring:** To enable the couple ring function, tick the checkbox beside the **Enable Couple Ring** string label.
 - **Couple Port:** Assign the member port which is connected to the other ring group.
 - **Control Port:** When the **Enable Couple Ring** checkbox is ticked, you have to assign the control port to form a couple-ring group between the two X-rings.
- **Enable Dual Homing:**
 - Set up one of the ports on the switch to be the Dual Homing port. For a switch, there is only one Dual Homing port. Dual Homing function only works when the X-Ring function enabled.
- **Enable Central Ring x:** Tick the checkbox beside the string label of **Enable Central Ring x** to assign two ports as the blocking & forwarding ports of the ring.
 - **1st Ring Port:** Assign a port which is used to be the forwarding port to the ring.
 - **2nd Ring Port:** Assign a port which is used to be the blocking port to the ring.
- And then, click **Apply** button to apply the configuration
- **When the X-Ring function enabled, the user must disable the RSTP. The X-Ring function and RSTP function cannot exist on a switch at the same time.**
- Remember to execute the “Save Configuration” action, otherwise the new configuration will lose when switch powers off.

LCSI Switches' X-Ring Features Table

Not all below models are generally available and some are build-to-order or MOQ required.

LCSI Product Model	Temperature Range	Port Interface	X-Ring	Couple Ring	Dual Homing
IES-M042C(E)	-10 to +60C & -40 to +75C	4*10/100TX + 2* Copper/SFP Combo	Yes	Yes	Yes
IES-M082C(E)	-10 to +60C & -40 to +75C	8*10/100TX + 2* Copper/SFP Combo	Yes	Yes	Yes
IESP-M082C(E)	-10 to +60C & -40 to +75C	8*10/100TX PoE + 2* Copper/SFP Combo	Yes	Yes	Yes
IES-M073C(E)	-10 to +60C & -40 to +75C	7*10/100TX + 3* Copper/SFP Combo	Yes	Yes	Yes
IES-M162C(E)	-10 to +60C & -40 to +75C	16*10/100TX + 2* Copper/SFP Combo	Yes	Yes	Yes
IGS-M044GB(E)	-10 to +60C & -40 to +75C	4*10/100/1000T + 4* SFP	Yes	Yes	Yes
IGS-M062C(E)	-10 to +60C & -40 to +75C	6*10/100/1000T + 2* SFP Combo	Yes	Yes	Yes
IES-M242H	-40 to +85C	24*10/100TX + 2* Giga SFP Combo	Yes	Yes	Yes
IES-M0242C	-10 to +60C	24*10/100TX + 2* Copper/SFP Combo	Yes	Yes	Yes
IESP-M0242C	-10 to +60C	24*10/100TX PoE + 2* Copper/SFP Combo	Yes	Yes	Yes
IES-M080E-M12-IP67	-40 to +75C	8-port 10/100TX M12 Managed Industrial Switch(IP67 Enclosure) -40 to +75C	Yes	Yes	Yes
IES-M082FE-M12-IP67	-40 to +75C	8-port 10/100TX + 2 x 100FX M12 Managed Industrial Switch(IP67 Enclosure) -40 to +75C	Yes	Yes	Yes

Examples to Configure

1. X-ring
2. Couple Ring
3. Dual Homing
4. Dual Ring (No longer support in Industrial Managed Switch shipped January, 2010)
5. Central Ring (No longer support in Industrial Managed Switch shipped January, 2010)

1.

Example : Configure X-Ring

X Ring Network Diagram example

IP Configuration IP Configuration IP Configuration

192.168.16.20

DHCP Client :

IP Address	192.168.16.10
Subnet Mask	255.255.255.0
Gateway	192.168.16.254
DNS1	0.0.0.0
DNS2	0.0.0.0

DHCP Client :

IP Address	192.168.16.20
Subnet Mask	255.255.255.0
Gateway	192.168.16.254
DNS1	0.0.0.0
DNS2	0.0.0.0

DHCP Client :

IP Address	192.168.16.30
Subnet Mask	255.255.255.0
Gateway	192.168.16.254
DNS1	0.0.0.0
DNS2	0.0.0.0

X-Ring

Ring Master

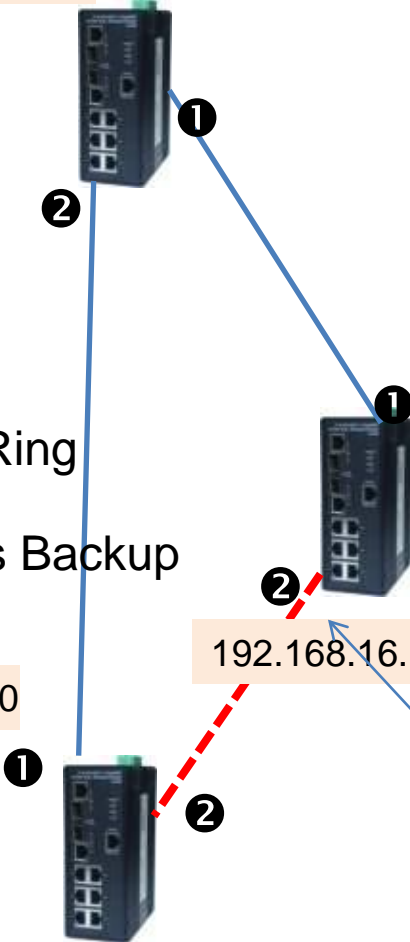
In the next slides, you can see both 192.168.16.10 and 192.168.16.20 are enabled as ring master but 192.168.16.10 has lower MAC address so it is selected as Ring Master

Blocked port is always at ring master's 2nd ring port

Dot Line is Backup

192.168.16.10

192.168.16.30



Selected as Ring Master

192.168.16.10
(Lower MAC Address)

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING

192.168.16.20
(Higher MAC Address)

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

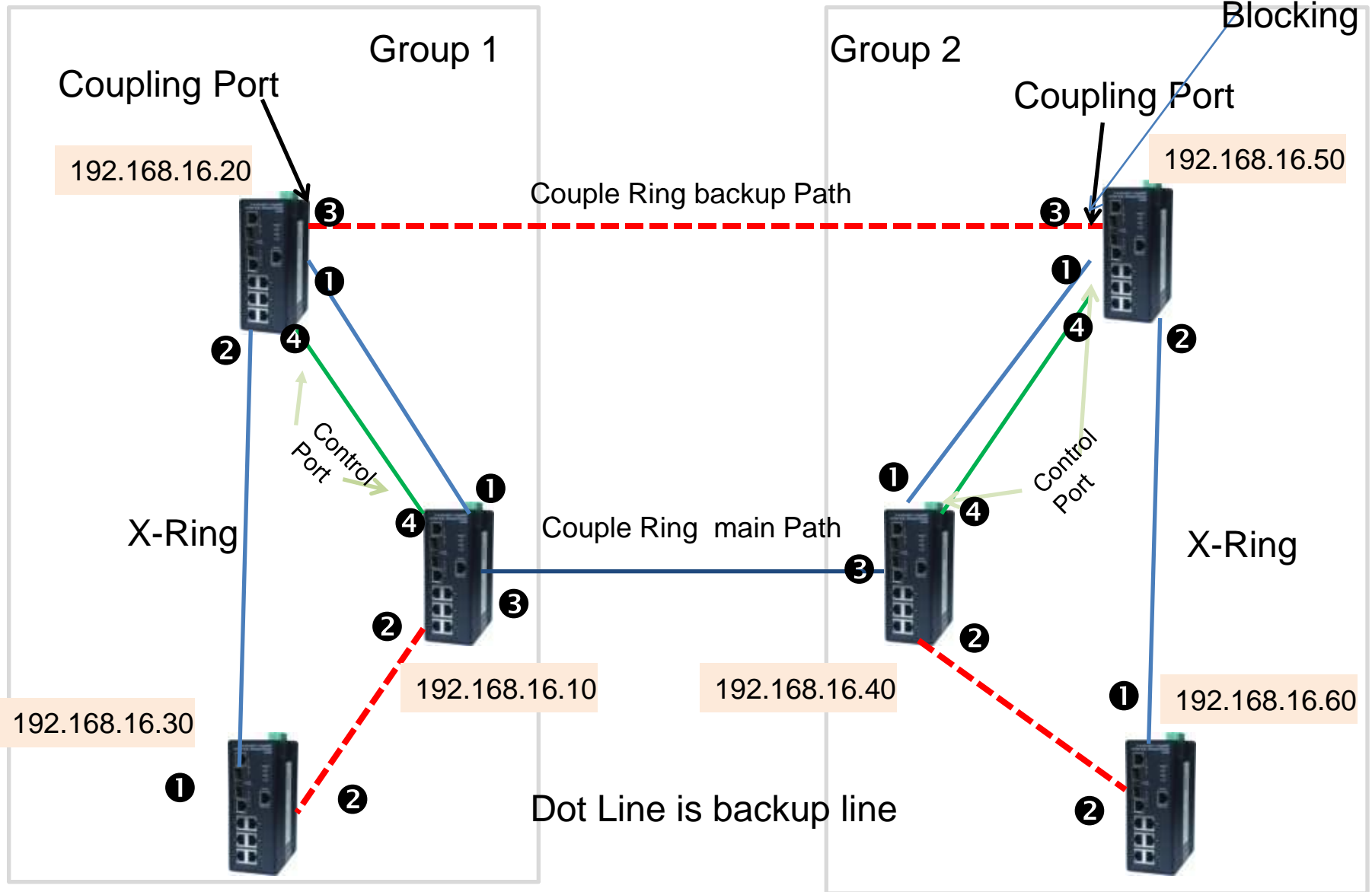
192.168.16.30

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

2.

Example: Configure Couple Ring

Couple Ring Network Diagram



2 Group * (Each group has 3 switches)

Group 1: X-Ring

IP Configuration

DHCP Client :

IP Address	192.168.16.10	IP Address	192.168.16.20	IP Address	192.168.16.30
Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0
Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254
DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0
DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0

Set up 1- to 6 by 192.168.16.10 to 192.168.16.60

Group 2: X-Ring

IP Configuration

DHCP Client :

IP Address	192.168.16.40	IP Address	192.168.16.50	IP Address	192.168.16.60
Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0
Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254
DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0
DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0

Couple Ring Configuration

192.168.16.10 →

- Group 1 Ring Master
- Primary Couple Ring path
 - Couple Port
 - Control Port

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING
<input checked="" type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	FORWARDING
Control Port	Port.04	BLOCKING
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING

This switch is Ring Master.

192.168.16.20 →

- Backup Couple Ring Path
 - Couple port
 - Control Port

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input checked="" type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	FORWARDING
Control Port	Port.04	BLOCKING
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

Apply Help

192.168.16.30 →

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

Couple Ring Configuration

- 192.168.16.40 →
- Group 2 Ring Master
 - Primary Couple Ring path
 - Couple Port
 - Control Port

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING
<input checked="" type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	FORWARDING
Control Port	Port.04	BLOCKING
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING

- 192.168.16.50 →
- Backup Couple Ring Path
 - Couple port
 - Control Port

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input checked="" type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	BLOCKING
Control Port	Port.04	BLOCKING
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

192.168.16.60 →

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.07	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

3.

Example: Configure Dual Homing

In Dual Homing application architecture, the upper level switches(not necessary to be LCSI Switch and can be other vendors' switch with RSTP features) need to enable the Rapid Spanning Tree protocol. But in this example, we use LCSI switch to configure.

Two X-Rings and connect to upper level running RSTP.

Ring 1: 4 Switches: 192.168.16.10 , 20, 30, 40

Ring 2: 4 Switches: 192.168.16.50, 60, 70, 80

Dual Homing

RSTP area: 192.168.16.100 & 192.168.16.200

IP Address	192.168.16.10	IP Address	192.168.16.20	IP Address	192.168.16.30	IP Address	192.168.16.40
Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0
Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254
DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0
DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0

IP Address	192.168.16.50	IP Address	192.168.16.60	IP Address	192.168.16.70	IP Address	192.168.16.80
Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0
Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254
DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0
DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0

DHCP Client : ▾

IP Address	192.168.16.100
Subnet Mask	255.255.255.0
Gateway	192.168.16.254
DNS1	0.0.0.0
DNS2	0.0.0.0

DHCP Client : ▾

IP Address	192.168.16.200
Subnet Mask	255.255.255.0
Gateway	192.168.16.254
DNS1	0.0.0.0
DNS2	0.0.0.0

Group A

192.168.16.10(Higher MAC, not as Ring Master although enabled as Ring Master)

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

192.168.16.20

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input checked="" type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	FORWARDING
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

Ring master's port two is blocked

Ring Master

192.168.16.30

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input checked="" type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	FORWARDING
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

192.168.16.40(Lower MAC as Ring master)

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING

Group B

Ring Master

Ring master's port two is blocked

192.168.16.50

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING

192.168.16.70

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input checked="" type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	FORWARDING
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

192.168.16.60

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input checked="" type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	FORWARDING
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

192.168.16.80

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
Control Port	Port.04	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING

RSTP Background

- The Rapid Spanning Tree Protocol (RSTP) is an evolution of the Spanning Tree Protocol and provides for faster spanning tree convergence after a topology change. The system also supports STP and the system will auto-detect the connected device that is running STP or RSTP protocol.

RSTP - System Configuration

- The user can view spanning tree information of Root Bridge.
- The user can modify RSTP state. After modification, click button.
 - **RSTP mode:** The user must enable the RSTP function first before configuring the related parameters.
 - **Priority (0-61440):** The switch with the lowest value has the highest priority and is selected as the root. If the value is changed, the user must reboot the switch. The value must be a multiple of 4096 according to the protocol standard rule.
 - **Max Age (6-40):** The number of seconds a switch waits without receiving Spanning-tree Protocol configuration messages before attempting a reconfiguration. Enter a value between 6 through 40.
 - **Hello Time (1-10):** The time that controls the switch to send out the BPDU packet to check RSTP current status. Enter a value between 1 through 10.
 - **Forward Delay Time (4-30):** The number of seconds a port waits before changing from its Rapid Spanning-Tree Protocol learning and listening states to the forwarding state. Enter a value between 4 through 30.
- **[NOTE]**
 - Follow the rule as below to configure the MAX Age, Hello Time, and Forward Delay Time.
 - $2 \times (\text{Forward Delay Time value} - 1) \geq \text{Max Age value} \geq 2 \times (\text{Hello Time value} + 1)$

RSTP - Port Configuration

- You can configure path cost and priority of every port.
- Select the port in the port column field.
- **Path Cost:** The cost of the path to the other bridge from this transmitting bridge at the specified port. Enter a number 1 through 200,000,000.
- **Priority:** Decide which port should be blocked by priority in LAN. Enter a number 0 through 240 (the port of the highest value will be blocked). The value of priority must be the multiple of 16.
- **Admin P2P:** Some of the rapid state transactions that are possible within RSTP are dependent upon whether the port concerned can only be connected to exactly one other bridge (i.e. it is served by a point-to-point LAN segment), or can be connected to two or more bridges (i.e. it is served by a shared medium LAN segment). This function allows the P2P status of the link to be manipulated administratively. True is P2P enabling. False is P2P disabling.
- **Admin Edge:** The port directly connected to end stations won't create bridging loop in the network. To configure the port as an edge port, set the port to "True" status.
- **Admin Non Stp:** The port includes the STP mathematic calculation. True is not including STP mathematic calculation. False is including the STP mathematic calculation.
- Click.Apply

If your connection and setting are correct, you can see Root ridge information at red dot line area

RSTP will choose lower priority value as root. So 192.168.16.100 is the RSTP root

System Configuration | Port Configuration

Open all

- Main Page
- System
- Port
- Protocol
 - VLAN
 - RSTP**
 - SNMP
 - QoS
 - IGMP
 - X-Ring
 - LLDP
- Security
- Factory Default
- Save Configuration
- System Reboot

RSTP Mode	
Priority (0-61440)	32768
Max Age (6-40)	20
Hello Time (1-10)	2
Forward Delay Time (4-30)	15

Priority must be a multiple of 4096
 $2 * (\text{Forward Delay Time} - 1)$ should be greater than or equal to the Max Age.
 The Max Age should be greater than or equal to $2 * (\text{Hello Time} + 1)$.

Apply Help

Root Bridge Information	
Bridge ID	0080000F380335C5
Root Priority	32768
Root Port	Root
Root Path Cost	0
Max Age	20
Hello Time	2
Forward Delay	15

System Configuration | Port Configuration

RSTP Mode	
Priority (0-61440)	61440
Max Age (6-40)	20
Hello Time (1-10)	2
Forward Delay Time (4-30)	15

Priority must be a multiple of 4096
 $2 * (\text{Forward Delay Time} - 1)$ should be greater than or equal to the Max Age.
 The Max Age should be greater than or equal to $2 * (\text{Hello Time} + 1)$.

Apply Help

Root Bridge Information	
Bridge ID	0080000F380335C5
Root Priority	32768
Root Port	8
Root Path Cost	20000
Max Age	20
Hello Time	2
Forward Delay	15

192.168.16.100 RSTP- Port Configuration

It is show the RSTP connection status by each port.

Port.02 ->192.168.16.20

Port.06 ->192.168.16.60

Port.13 ->192.168.16.200

Port.15 ->192.168.16.200

System Configuration Port Configuration

Port	Path Cost (1-20000000)	Priority (0-240)	Admin P2P	Admin Edge	Admin Non Stp
Port.01					
Port.02	200000	128	Auto	true	false
Port.03					
Port.04					
Port.05					

priority must be a multiple of 16

Apply Help

RSTP Port Status

Port	Path Cost	Port Priority	Oper P2P	Oper Edge	Stp Neighbor	State	Role
Port.01	2000000	128	True	True	False	Disabled	Disabled
Port.02	200000	128	True	False	False	Forwarding	Designated
Port.03	200000	128	True	True	False	Disabled	Disabled
Port.04	200000	128	True	True	False	Disabled	Disabled
Port.05	200000	128	True	True	False	Disabled	Disabled
Port.06	200000	128	True	False	False	Forwarding	Designated
Port.07	200000	128	True	True	False	Disabled	Disabled
Port.08	200000	128	True	True	False	Disabled	Disabled
Port.09	200000	128	True	True	False	Disabled	Disabled
Port.10	200000	128	True	True	False	Disabled	Disabled
Port.11	200000	128	True	True	False	Disabled	Disabled
Port.12	200000	128	True	True	False	Disabled	Disabled
Port.13	200000	128	True	False	False	Forwarding	Designated
Port.14	200000	128	True	True	False	Disabled	Disabled
Port.15	200000	128	True	False	False	Forwarding	Designated
Port.16	200000	128	True	True	False	Disabled	Disabled
Port.17	20000	128	True	True	False	Disabled	Disabled
Port.18	20000	128	True	True	False	Disabled	Disabled

192.168.16.20

192.168.16.60

192.168.16.200

192.168.16.200 RSTP- Port Configuration

It is show the RSTP connection status by each port.

Port.03 ->192.168.16.30

Port.06 ->192.168.16.70

Port.07 ->192.168.16.100

Port.08 ->192.168.16.100

System Configuration Port Configuration

Port	Path Cost (1-200000000)	Priority (0-240)	Admin P2P	Admin Edge	Admin Non Stp
Port.01					
Port.02					
Port.03	20000	128	Auto	true	false
Port.04					
Port.05					

priority must be a multiple of 16

Apply Help

RSTP Port Status

Port	Path Cost	Port Priority	Oper P2P	Oper Edge	Stp Neighbor	State	Role
Port.01	20000	128	True	True	False	Disabled	Disabled
Port.02	20000	128	True	True	False	Disabled	Disabled
Port.03	20000	128	True	False	False	Forwarding	Root
Port.04	20000	128	True	True	False	Disabled	Disabled
Port.05	20000	128	True	True	False	Disabled	Disabled
Port.06	20000	128	True	False	False	Discarding	Alternated
Port.07	20000	128	True	False	False	Discarding	Alternated
Port.08	20000	128	True	False	False	Discarding	Alternated

192.168.16.30

192.168.16.70

192.168.16.100

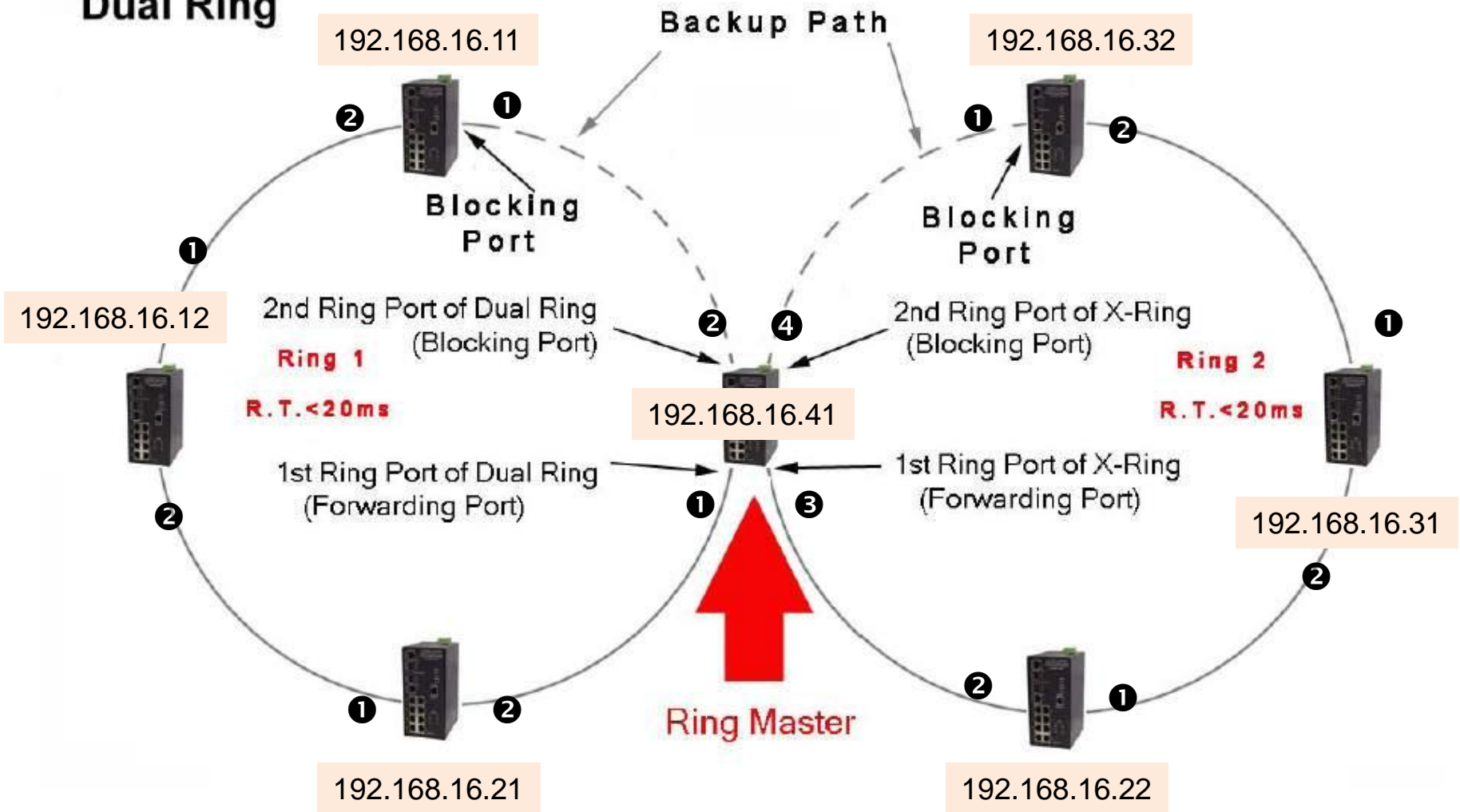
RSTP Backup Path

4.

Example: Configure Dual Ring
(This Features is no longer
supported in switch shipped
after January, 2010)

Dual Ring Configuration

Dual Ring



Dual Ring configuration

- Assign 192.168.16.41 as ring master
- Enable X-Ring in switches (They are all the same configuration)
 - Ring 1: 192.168.16.11, 192.168.16.12, 192.168.16.21
 - Ring 2: 192.168.16.22, 192.168.16.31, 192.168.16.32
- Dual ring switch must be enabled as ring master to have Dual ring function well

X-Ring Configuration

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	BLOCKING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.01	FORWARDING
Control Port	Port.01	FORWARDING
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.01	FORWARDING
<input checked="" type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.03	FORWARDING
2nd Ring Port	Port.04	BLOCKING

This switch is Ring Master.

Apply Help

192.168.16.41

X-Ring Configuration

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.02	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.01	FORWARDING
Control Port	Port.01	FORWARDING
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.01	FORWARDING
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01	FORWARDING
2nd Ring Port	Port.01	FORWARDING

Apply Help

192.168.16.11, 192.168.16.12, 192.168.16.21,
192.168.16.22, 192.168.16.31, 192.168.16.32,

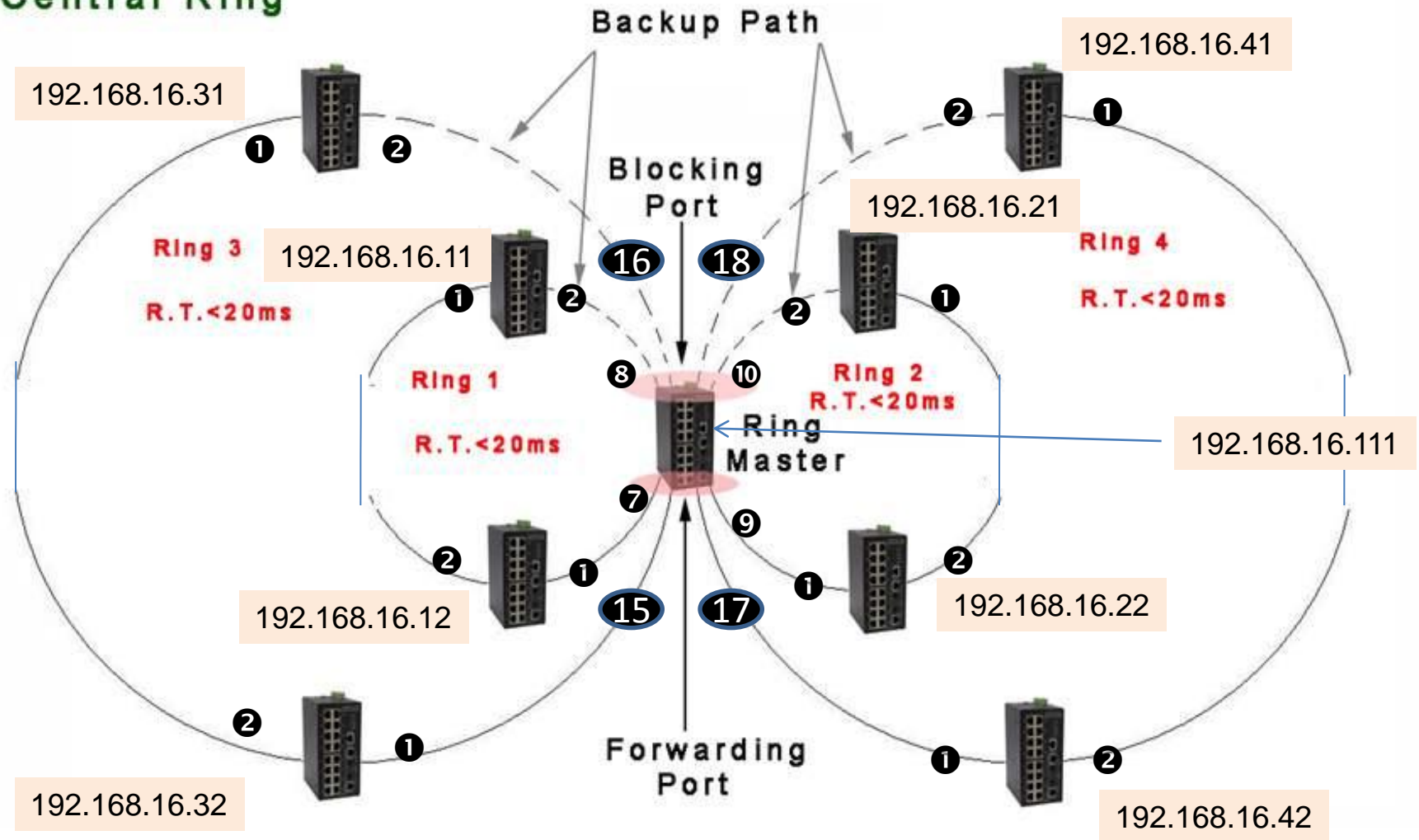
5.

Example: Configure Central Ring
(This Features is no longer
supported in switch shipped after
January, 2010)

Central Ring Configuration

* Can handle up to 4 Rings

Central Ring



IP Configuration : 8* Industrial Managed Switch (these switch does not need central ring

Central Ring Configuration

DHCP Client :

IP Address	192.168.16.11	IP Address	192.168.16.12	IP Address	192.168.16.21	IP Address	192.168.16.22
Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0
Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254
DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0
DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0

IP Address	192.168.16.31	IP Address	192.168.16.32	IP Address	192.168.16.41	IP Address	192.168.16.42
Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0	Subnet Mask	255.255.255.0
Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254	Gateway	192.168.16.254
DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0	DNS1	0.0.0.0
DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0	DNS2	0.0.0.0

IP Configuration of Central Ring Master switch (Not all LCSI Industrial Managed Switch has central , please check the X-ring feature table in this guide)

DHCP Client :

IP Address	192.168.16.111
Subnet Mask	255.255.255.0
Gateway	192.168.16.254
DNS1	0.0.0.0
DNS2	0.0.0.0

Enable Ring Master

Central ring switch(192.168.16.111) must be enabled as ring master to have central ring function run well. At most, up to 4 rings can be set at central ring)

X-Ring Configuration

192.168.16.111

<input checked="" type="checkbox"/> Enable Ring		
<input checked="" type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01	LINKDOWN
2nd Ring Port	Port.02	LINKDOWN
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.03	LINKDOWN
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.05	LINKDOWN
<input checked="" type="checkbox"/> Enable Central Ring 1		
1st Ring Port	Port.07	FORWARDING
2nd Ring Port	Port.08	BLOCKING
<input checked="" type="checkbox"/> Enable Central Ring 2		
1st Ring Port	Port.09	FORWARDING
2nd Ring Port	Port.10	BLOCKING
<input checked="" type="checkbox"/> Enable Central Ring 3		
1st Ring Port	Port.15	FORWARDING
2nd Ring Port	Port.16	BLOCKING
<input checked="" type="checkbox"/> Enable Central Ring 4		
1st Ring Port	Port.17	FORWARDING
2nd Ring Port	Port.18	BLOCKING

Central Ring 1

Central Ring 2

Central Ring 3

Central Ring 4

Central Ring Configuration

- Other than central Ring master switch, all switches are set to X-Ring enabled
- 192.168.16.11, 192.168.16.12, 192.168.16.21, 192.168.16.22, 192.168.16.31, 192.168.16.32, 192.168.16.41, 192.168.16.42

<input checked="" type="checkbox"/> Enable Ring		
<input type="checkbox"/> Enable Ring Master		
1st Ring Port	Port.01 ▼	FORWARDING
2nd Ring Port	Port.02 ▼	FORWARDING
<input type="checkbox"/> Enable Couple Ring		
Couple Port	Port.01 ▼	FORWARDING
Control Port	Port.01 ▼	FORWARDING
<input type="checkbox"/> Enable Dual Homing		
Homing Port	Port.01 ▼	FORWARDING
<input type="checkbox"/> Enable Dual Ring		
1st Ring Port	Port.01 ▼	FORWARDING
2nd Ring Port	Port.01 ▼	FORWARDING