CDS
ISA100 Wireless

Redundancy techniques to increase reliability in ISA100 Wireless networks
Single Gateway issue

On Gateway malfunction:
• wireless devices try to find another network
• battery consumption increases
• client application lose important sensors data
• Industrial process disruption
Redundant Gateway

On Gateway or connection malfunction:
- Wireless devices remain connected
- No battery consumption increase
- Client application continues to receive sensor data
- Faulty GW can be replaced without disrupting industrial process

Target: happy user
Client interfaces

Access INPUT and HOLDING registers

Client/Server, Notifications, Alerts

Ethernet infrastructure

Access INPUT registers

Notifications & Alerts

Modbus

INPUT
CURRENT ROLE
HOLDING
PREFERED ROLE
SHUTDOWN

GCI

Active VR900

Backup VR900

Ethernet synchronization link

Web tool

Web tool
Backup BBR is joined to Active SM and idle connection to Backup SM
Wireless network routes

• Dual active backbones
  o Faster joining process
• Redundant path for inbound traffic
• Redundant path for outbound traffic
• Redundant Client-Gateway connection
Network formation

- **Active Gateway:**
  - handle join requests
  - groom the network
- **Field devices join to**
  **Active Gateway through any BBR**
- **Active Gateway**
  configures redundant wireless path after join
Data packets flow

- ISA100 packets received from wireless through any of the BBR.
- BBR forward packets to Active Gateway
- Active Gateway updates Backup Gateway
- Same data available to Client application from any of the Gateway (through Modbus or GCI)
If anything breaks but data survives, user is happy

Cases of failure:
1. Eth connection Client application - Active Gateway
2. Active GW
3. RF connection Sensor – Gateway
4. Synchronization link Active- Backup
5. Backup Gateway
6. Eth connection Client application – Backup Gateway
1. Client application <-> Active Gateway failure

- Active GW continues to receive field data
- Data is synchronized between Active and Backup GW
- Client application continues to receive data from Backup GW
- Client application can command a software switch of roles through:
  - Modbus (PREFERED ROLE register)
  - GCI dedicated GRO (Gateway Redundancy Object)
- User can fix the broken connection without affecting process control
2. Active Gateway failure

1. Heartbeat mechanism detects failure in few seconds
2. Heartbeat triggers the role switch from Backup to Active
3. System Manager reconfigures field device paths to use only current GW over RF to preserve energy.

- During this process the client application continues to receive data
- User can replace the broken Gateway without affecting process control.
3. RF link Sensor – Gateway failure

- Redundancy path through both BBRs based on Multipath routing allow temporary RF link lost
- On each packet, failure on Preferred path triggers retry on Backup path
- On permanent RF link lost (based on PER statistics) System Manager reconfigures field devices paths
- No change on backend side
- Client application continues to receive data from Active GW
4. Synchronization link Active-Backup failure

- Active GW continues to receive field data from Active GW

1. Heartbeat on Backup GW detect the link lost
2. Heartbeat triggers switch from Backup to Active
3. Client application detects the dual role Active – Active and command a Gateway shutdown through:
   - Modbus (STOP register)
   - GCI dedicated GRO (Gateway Redundancy Object)

- User can fix the broken link and restart the GW without affecting process control
5. Backup Gateway failure

1. Heartbeat detects failure and no action required

2. Client application detects failed GW by losing connection with Backup

3. System Manager reconfigures field device paths to use only current GW over RF (triggered by high PER - packet error rate - statistics).

- During this process the client application continues to receive data from Active GW
- User can replace the broken Gateway without affecting process control.
6. Client application <-> Backup Gateway failure

- No change in the GW roles
- Active GW continues to receive field data
- Client application continues to receive data from Active GW
- User can fix the broken connection without affecting process control
Conclusions

• Redundancy mechanism increase the reliability of the system
• All failure links are covered
• Uses two identical gateways, one as Active and second as Backup
• Redundancy connection uses a dedicated Ethernet cable
• Does not require other special hardware
Q & A

Thank you

For further questions send an email to contact@cds.ro