ICE Radio Gateway Guide

Product guide for prerelease

Document version 1841, produced on Friday, September 06, 2024.

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1 Document History

Publication Date	Product Release	Notes
May 29, 2024	3.5.1	No updates.
April 15, 2024	3.5.0	No updates.
September 20, 2023	3.4.0	Updated version to 3.4.7252.
August 9, 2023	3.3.0	Deleted ‘`CLIENT_BRIDGE_ADDRESS=https://CLUSTER_FQDN`’ from `env` file, as it is unnecessary (the line being present does not prevent ICE Radio Gateway from running, though). Replaced `ic.repo.dillonkane.com/ice/gateway:` with `instantconnect/gateway:` in both the DFSIG and ISSIG ‘Running the container’ sections.
July 24, 2023	3.3.0	Updated version reference to 3.3.7007. Added ‘Create a directory for the self-signed certificates’ section. Updated ‘Certify P25 License dongle access’ section. Updated Docker run commands for both DFSIG and ISSIG.
April 25, 2023	3.2.0	Updated version reference to 3.3.6787.
December 1, 2022	3.2.0	Release updates. Updated to reflect ISSIG support. Added instructions for airgap installation of DFSIG / ISSIG. Updated version reference to 3.3.6445.
September 26, 2022	3.1.2	No updates.
April 25, 2022	3.1.1	Minor updates for release.
March 15, 2022	3.1.0	Document created.

2 Introduction

ICE Radio is a radio gateway integrating Instant Connect Enterprise’s push-to-talk communications with P25. Two types of radio gateways are supported: Digital Fixed Station Interface (DFSI) and Inter-RF Subsystem Interface (ISSI).

DFSIG

- Two-way voice communications occur between ICE users and P25 radio users via ICE Radio and one or more P25 Fixed Stations.
- ICE Radio handles transcoding between vocoder audio streams on the ICE side and Improved Multi-Band Excitation (IMBE) over a DFSI. P25 encryption is an available option.

ISSIG

- Two-way voice communications occur between ICE users and P25 radio users via ICE Radio and an external Radio System or external ISSIG.
- ICE Radio handles transcoding between vocoder audio streams on the ICE side and IMBE over an ISSI. P25 encryption is an available option.

> **Note:** On an ICE Radio Gateway operating as ISSIG, neither talkgroups nor subscribers are homed, thus the gateway unit ID and all talkgroups must be homed elsewhere in the system, either on an external ISSIG or a Radio System with RFSS.

2.1 Host System

ICE Radio is designed to run outside of the ICE Server's Kubernetes cluster. This deployment model allows network administrators to maintain separate networks for radio systems and clustered applications.

The ICE Radio software acts as a bridge between these systems, picking up radio traffic from the network and distributing it to ICE users via one or more optional RallyPoint nodes, and should be deployed on a host system on a network with full network access to radio communications.

2.1.1 Hardware requirements

ICE Radio should be installed on a physical server or virtual machine that can dedicate the following resources to it:

- Ubuntu Linux 18.04 LTS or 20.04 LTS (Server and non-desktop version)
- 4 CPU cores (or equivalent)
- 4 GB RAM
- 80 GB storage

ICE Radio requires full-time use of a P25 License Dongle:

- This USB dongle must be plugged into an available USB port on the physical server.
- Once installed, the virtual machine dedicated to ICE Radio must be configured to use a USB Device. The dongle will appear as 'Microcomputer Applications KEYLOK II' when selecting a USB device.

> **Note:** Use of VMWarec VMotion is not supported by the dongle.

2.1.2 Software requirements

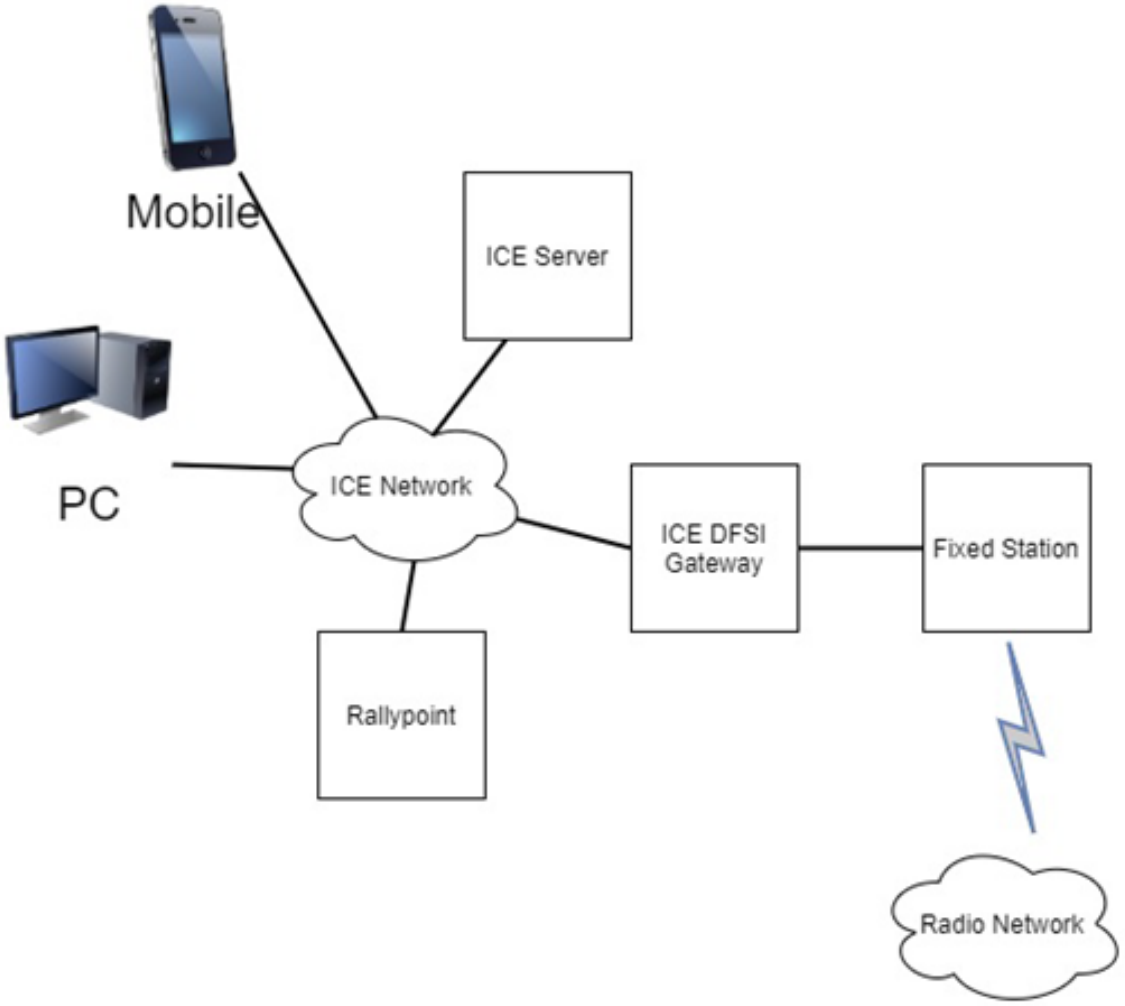
ICE Radio is delivered as a Docker container that is intended to run on a Linux host operating system. Aside from Docker, ICE Radio requires no additional software to be present on the host system.

At this time, only Linux host systems are supported

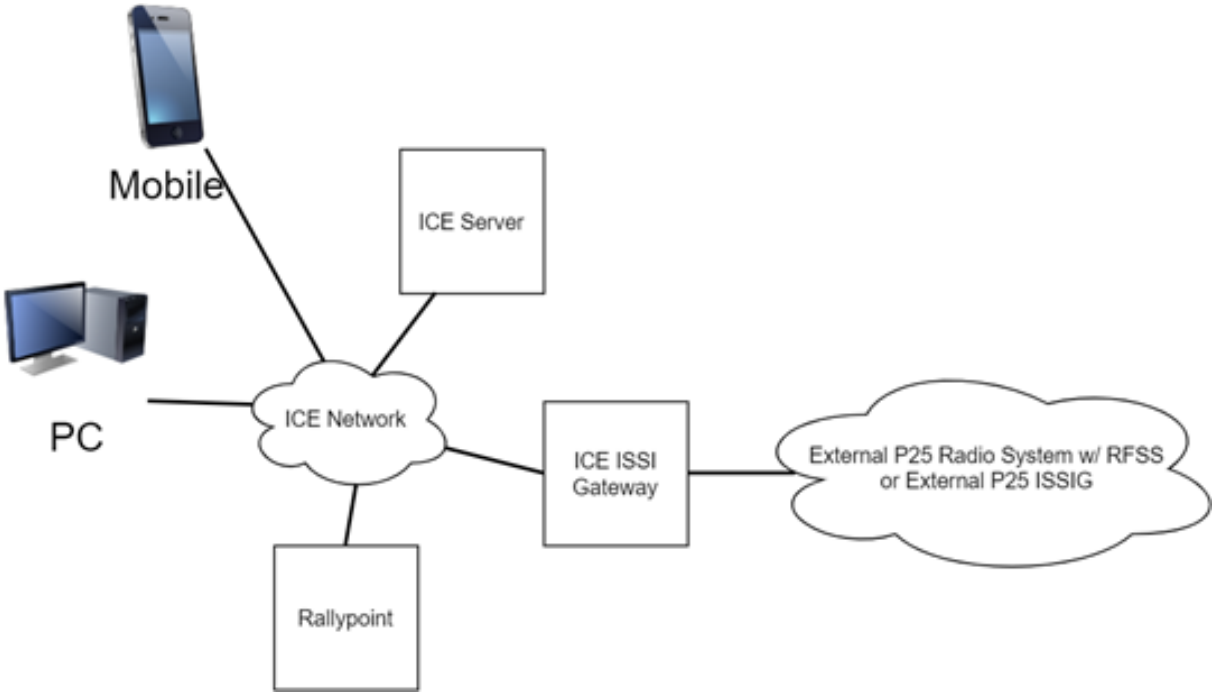
2.1.3 Network requirements

The ICE Radio component requires connectivity to the ICE Server. ICE Radio will connect to ICE Server in the same manner as an ICE Desktop or ICE Mobile client would (using either an HTTP or HTTPS web socket connection). If assigned channels used by ICE Radio are configured to use one or more Rally Points, then ICE Radio requires connectivity to these Rally Points.

DFSIG


Mobile
ICE Server
PC
ICE Network
ICE DFSI Gateway
Fixed Station
Rallypoint
Radio Network

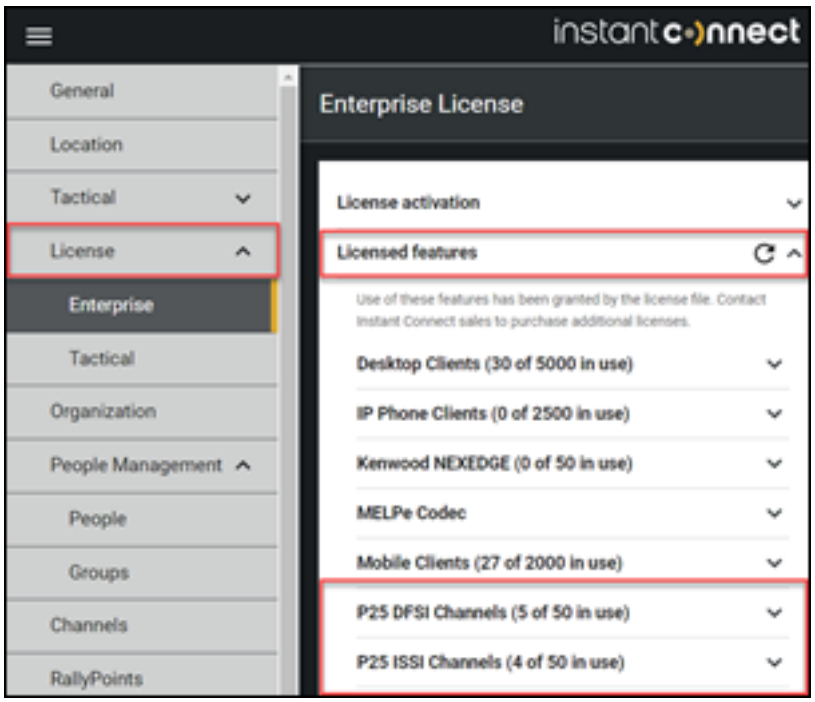
ISSIG



2.2 Feature License

ICE Radio is an independently licensed feature of Instant Connect Enterprise. Verify that your system has the appropriate licensed features installed.

1. Open and log in to ICE Desktop.
2. Navigate to ‘Settings’ > ‘License’ > ‘License features’.
3. Look for the presence of DFSI and/or ISSI (based on your license).



> **Note:** If you do not see a licensed feature, please contact your Instant Connect sales representative for assistance.

3 Prerequisites

Assure that each of the following prerequisites have been met before proceeding with installation.

3.1 DFSIG: P25 Fixed Stations

ICE Radio provides the interface between ICE users and one or more P25 Fixed Stations. ICE Radio establishes and controls a DFSI connection to every P25 Fixed Station.

P25 Fixed Stations and assigned channels are provisioned in the ICE system. Every provisioned P25 Fixed Station is associated to a specific assigned channel. ICE users on these channels can transmit voice calls into the P25 Fixed stations. ICE users can also receive voice calls received by the P25 Fixed Stations.

3.2 ISSIG: P25 Talkgroups

ICE Radio provides the interface between ICE users and one or more P25 talkgroups. The ICE Radio Gateway communicates with a single P25 Radio System.

A P25 Radio System can be either an external ISSIG or external radio system with RFSS. Every provisioned P25 talkgroup is associated to a specific assigned channel. ICE users on these channels can transmit voice calls into P25 talkgroups. ICE users can also receive voice calls initiated by other P25 users on these P25 talkgroups.

4 Setup

The installation of ICE Radio is intended to occur after your ICE Server system has been installed, licensed and tested. Complete the primary system configuration before proceeding with ICE Radio integration.

4.1 Install Docker

Follow the official Docker installation instructions for your Linux distribution, if your system is not already equipped with Docker.

For Ubuntu: Install docker using steps at: https://docs.docker.com/engine/install/ubuntu/

For RedHat 7:

```
sudo yum install docker -y
sudo systemctl enable docker.service
sudo systemctl start docker.service
sudo usermod -a -G dockerroot $(whoami)
sudo setfacl --modify user:$(whoami):rw /var/run/docker.sock
```

Verify the user ID (UID) and group ID (GID) specify 1000. If the IDs specify another user, like 1001, then the docker won't mount the logs to the `dfsi-logs` folder.

To determine what user the IDs currently specify, enter:

```
id
```

If the output not uid=1000(iceadmin) gid=1000(iceadmin) groups=1000(iceadmin), then run the following commands:

- To specify UID = 1000, enter:

```
sudo usermod -u 1000 iceadmin
```

- To specify GID = 1000, enter:

```
sudo groupmod -g 1000 iceadmin
```

Log out from putty/ssh or reboot VM, so that the user has permissions to access the Docker daemon

Verify your Docker installation with `docker run hello-world`, which should pull the `hello-world` Docker image and run it, displaying some information about your installation.

> **Do not proceed** until you have verified your Docker environment is able to run the `hello-world` test.

4.2 Create a directory for the self-signed certificate

Run the following command:

```
mkdir /home/icetadmin/certs
```

Then place the self-signed root certificate (ending in .crt) in that directory.

4.3 Certify P25 License dongle access

Run the `lsusb` command to verify the USB dongle can be read by the host OS. For `KEYLOK II`, take note of the `BusNum` and `DeviceNum` values, as they will be required later when executing the docker run command (see the *'Running the container'* section below). In the following example, the `KEYLOK II` values are `BusNum (002)` and `DeviceNum (004)`.

```
iceadmin@ice-radio:~$ lsusb
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 004: ID 07f2:0001 Microcomputer Applications, Inc. KEYLOK
   II
Bus 002 Device 003: ID 0e0f:0002 VMware, Inc. Virtual USB Hub
Bus 002 Device 002: ID 0e0f:0003 VMware, Inc. Virtual Mouse
Bus 002 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
iceadmin@ice-radio:~$
```

> **Note:** Do *NOT* remove the USB dongle. Once it is inserted, moving it another port or even reinserting it in the same port will update the `BusNum (002)` and `DeviceNum (004)` values.

4.4 Connect to the Instant Connect Docker repository

You'll also need to log into Instant Connect's private Docker repository to pull and run our Docker container.

4.4.1 Log in to Docker

Log into Docker with the following command:

```
docker \
  login docker.io \
  -u iccustomeraccess \
  -p 7dcb7799-f418-4651-ab65-66feec2a4234
```

4.4.2 Verify the ICE Radio container

Verify you can pull the ICE Radio container by executing:

```
docker pull instantconnect/gateway:3.4.7252
```

4.4.3 Create an env file

> **Note:** For now, you will have to manually enter the IP addresses of the Arcus cluster you are connecting to and the public IP address of the node you're using to host ICE-Radio into the file `env`.

We need to pass in several environment variables, we do so by creating an `env` file to feed into docker. It's easiest to build this from your workstation, then upload it to your ICE Radio node. The structure of the file is as follows:

```
SERVER_BRIDGE_ADDRESS=https://CLUSTER_FQDN/server-bridge
INGRESS_IP=your ICE Radio node ip
GATEWAY_TYPE=dfsi or issi
ICE_OPEN_TELNET_CLI=Y
ICE_CONF_crash_reporting_feature_enabled=true
GATEWAY_PLATFORM_LOGIN_TOKEN=<token from your ICE Desktop>
ICEGW_LOG_LEVEL=debug
```

> **Notes:**
>
> - The ICE Server environment variables *must* begin with `https://` or `http://`. `INGRESS_IP` *must not* begin with either. For a server without certificates or FQDN, use `http://\<Your Server IP\>`.
> - Every Radio gateway instance must be set to either `dfsi` *or* `issi`.
> - If crash reporting is not desired, set `ICE_CONF_crash_reporting_feature_enabled` to **`false`**.

Populate the `GATEWAY_PLATFORM_LOGIN_TOKEN` variable with the token code generated as part of creating a DFSI or ISSI gateway via the ICE Desktop client.

> **Notes:**
>
> - Please refer to the ***ICE Desktop User Guide*** for more detailed information on creating a DFSI or ISSI gateway.
> - If your cluster is not using certificates, replace `https` with `http`.
> - The token must not include double-quotation marks.

5 DFSIG: Running the container

To run the image from your ICE Radio host node, use the following command:

> **Note:** We recommend you create the `env` file and run the following commands in the home directory. Enter `cd` to get there.

```
mkdir -p dfsi-logs
docker run --device=/dev/bus/usb/002/004:/dev/bus/usb/002/004  --detach
   --net=host  --volume "$(pwd)/dfsi-logs":/home/gateway/ice/logs  --
   volume $(pwd)/dfsi-cores:/tmp  --volume $(pwd)/certs:/usr/local/share/
   ca-certificates --name dfsi  --env-file env  --restart always  --add-
   host=01.002.00003.p25dr:127.0.0.1  instantconnect/gateway:3.4.7252 &&
   docker exec -it dfsi update-ca-certificates
```

In the example above, for `--device=`, the `BusNum (002)` and `DeviceNum (004)` values were retrieved using the `lsusb` command for the P25 License dongle. See the *'Verify P25 License dongle access'* section above.

After the DFSIG is running, verify the radio container has detected the P25 License Dongle. `Valid` must appear as shown in the example below:

```
cd dfsi-logs
icetadmin@ice-tele-113:~/dfsi-logs$ grep License pie.log
[2021-07-26 15:14:37.158300] [160] [I] [PieWrapperMgmtCallback.cpp:101]
   <-- LicenseStatusInd : Valid   maxVoiceStreams 200 CSSI, 200 DFSI, 200
   DFSI (via CAR), S/W crypto true, H/W crypto false, OTNR true, Phase 2
   false
icetadmin@ice-tele-113:~/dfsi-logs$
```

Useful commands for viewing the status are:

```
docker container ls -a
docker ps -a
```

```
docker stats
```

If you need to restart and/or stop and remove the radio container:

```
docker restart dfsi && docker stop dfsi && docker rm dfsi
```

> **Important**: Removing container with docker rm dfsi would not reclaim disk space. Docker images can consume large amounts of disk space. Consult the official Docker Docs website to learn how to remove unused Docker images with the `docker image prune -a` command. The `docker system prune -a` command will also clean up unused containers and images, but exercise caution in deleting constrainers that are in use.

To view logs on console:

```
docker logs dfsi
```

6 ISSIG: Running the container

To run the image from your ICE Radio host node, use the following command:

> **Note:** We recommend you create the `env` file and run the following commands in the home directory. Enter `cd` to get there.

```
mkdir -p issi-logs
docker run --device=/dev/bus/usb/002/004:/dev/bus/usb/002/004 --detach --
    net=host --volume "$(pwd)/issi-logs":/home/gateway/ice/logs  --volume $
    (pwd)/issi-cores:/tmp --volume $(pwd)/certs:/usr/local/share/ca-
    certificates --name issi --env-file env --restart always instantconnect
    /gateway:3.4.7252 && docker exec -it issi update-ca-certificates
```

In the example above, for `--device=`, the `BusNum (002)` and `DeviceNum (004)` values were retrieved using the `lsusb` command for the P25 License dongle. See the *'Verify P25 License dongle access'* section above.

After the ISSIG is running, verify the radio container has detected the P25 License Dongle. `Valid` must appear as shown in the example below:

```
cd issi-logs
icetadmin@ice-tele-113:~/issi-logs$ grep License pie.log
[2021-07-26 15:14:37.158300] [160] [I] [PieWrapperMgmtCallback.cpp:101]
    <-- LicenseStatusInd : Valid maxVoiceStreams 200 CSSI, 200 DFSI, 200
    DFSI (via CAR), S/W crypto true, H/W crypto false, OTNR true, Phase 2
    false
icetadmin@ice-tele-113:~/issi-logs$
```

Useful commands for viewing the status are:

```
docker container ls -a
docker ps -a
docker stats
```

If you need to restart and/or stop and remove the radio container:

```
docker restart issi && docker stop issi && docker rm issi
```

> **Important:** Removing container with docker rm issi would not reclaim disk space. Docker images can consume large amounts of disk space. Consult the official Docker Docs website to learn how to remove unused Docker images with the docker image prune -a command. The docker system prune -a command will also clean up unused containers and images, but exercise caution in deleting constrainers that are in use.

To view logs on console:

```
docker logs issi
```

7 Airgap installation of DFSI / ISSI gateways

> **Note:** Each gateway host VM must be configured as either a DFSIG or an ISSIG. For customers using both DFSIG and ISSIG, two VMs are required, one for each type. The process below is then performed twice, once for the DFSIG, and once for the ISSIG.

1. Docker must be installed. Please refer to the following link for information on: Installing Docker in Airgapped Environments
2. Download the appropriate .tar file from the Instant Connect Support Portal:
    1. Navigate to: https://support.instantconnectnow.com/s/downloads
    2. Select the 'Instant Connect Enterprise Software' folder.
    3. Select the 'ICE 3.x.x Software' folder (the latest version).
    4. **For DFSIG:** Download the 'ICE_DFSI_Gateway_Airgap_3.x.x.tar' file.

       For ISSIG: Download the 'ICE_ISSI_Gateway_Airgap_3.x.x.tar' file.
3. Upload the .tar file to the appropriate gateway host virtual machine (VM).
4. On the VM, execute the following command:
    - **For DFSIG:**

```
docker load -i ICE_DFSI_Gateway_Airgap_3.x.x.tar
```

- **For ISSIG:**

```
docker load -i ICE_ISSI_Gateway_Airgap_3.x.x.tar
```

5. On the VM, execute the appropriate `docker run` command as documented in the DFSIG or ISSIG *'Running the container'* sections above.