



Intelligently Detecting Physical Cell ID Collision and Confusion

Running the PCI Optimizer rApp from P.I. Works on VMware Centralized RIC to Resolve Code Conflicts

PARTNER SOLUTION AT A GLANCE

The P.I. Works PCI Optimizer rApp resolves existing PCI code conflicts and proactively detects and resolves potential future clashes using the standard interfaces supplied by VMware Centralized RIC.

COMPANY OVERVIEW

P.I. Works is an independent provider of AI-driven and automated mobile network planning, management, and optimization solutions. P.I. Works combines its field-proven expertise with a diverse portfolio of products and services to enable mobile network operators to accelerate their digital transformation, resulting in cost reductions, energy savings, and improved customer experiences. P.I. Works has deployed its solutions at 67 mobile network operators in 47 countries.

<https://piworks.net/>

The Need for PCI Optimization in 5G Networks

The physical cell identifier, or PCI, is a key identifier used in 5G networks to allow mobile devices to separate information from different cells. There are 1,008 PCI values permitted in the 5G standards, which is far less than the number of possible cells in a commercial network. As a result, PCI values must be reused across the network, which creates the potential for conflicts: If neighboring cells share the same PCI and frequency, a mobile device cannot distinguish between the cells and this conflict can affect service quality.

There are two distinct types of conflicts:

- PCI confusions occur when a 5G cell has two different neighbor cells with equal PCIs in the same frequency band.
- PCI collisions happen when a 5G cell has a neighbor cell with an identical PCI in the same frequency band.

These conflicts can lead to dropped calls and difficulties in obtaining service.

Operators use PCI planning tools to avoid conflicts; however, the dynamic nature of 5G networks, with changing cell ranges and the need for denser networks to improve coverage, conflicts still occur.

P.I. Works PCI Optimizer rApp

P.I. Works PCI Optimizer rApp resolves existing PCI code conflicts in a 5G network and uses intelligent algorithms to proactively detect and resolve potential future

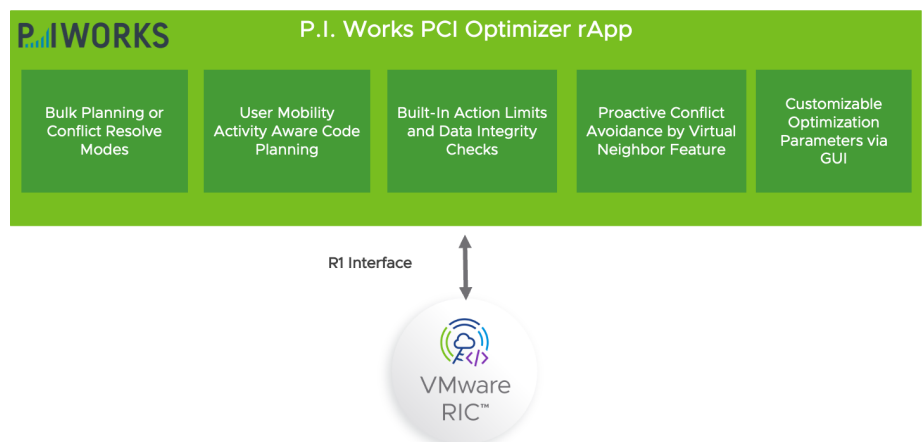


FIGURE 1: The PCI Optimizer rApp from P.I. Works runs on VMware RIC to detect and resolve physical cell ID collisions and conflicts.

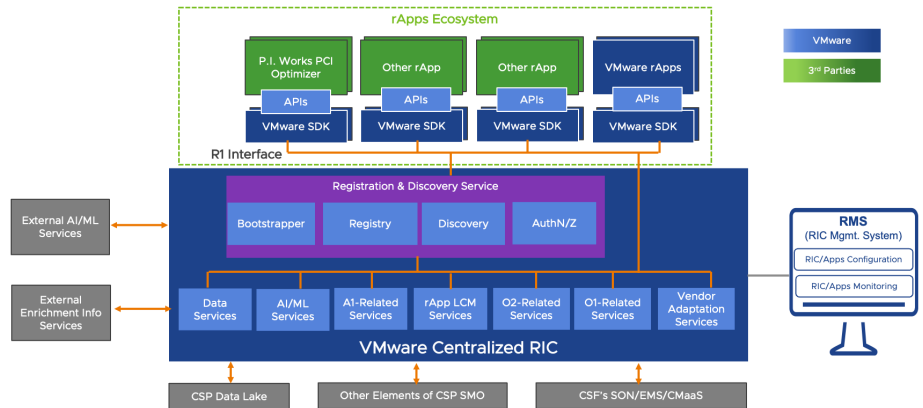


FIGURE 2: The PCI Optimizer rApp from P.I. Works uses data from the services of VMware Centralized RIC to detect and resolve physical cell ID collisions and conflicts.

clashes. It is integrated with VMware Centralized RIC through the standard R1 interface, and it uses the services supplied by the RIC to obtain network data and to update configurations.

Components

To identify existing or potential conflicts, the PCI Optimizer rApp consists of a number of modules that process information received through the R1 interface from VMware RIC. The rApp first provides reports on PCI conflicts and confusions it finds, and then it can be used to generate a revised PCI plan to eliminate the conflicts.

How it Works

An example illustrates how the rApp works. If the PCI Optimizer rApp is used to identify PCI conflicts in a 5G test bed consisting of 674 cells and the rApp discovers four real PCI conflicts and two PCI confusions, the rApp derives an improved PCI planning solution that eliminates the conflicts.

To achieve this planning solution, the rApp uses different services furnished by VMware Centralized RIC. The current PCI plan is obtained through fetching connection management data, and the service quality provided by the RAN is obtained by retrieving performance measurement data from the RIC.

When the rApp discovers PCI conflicts between cells, it updates the RAN with new PCI values that eliminate the conflicts by using write commands supported by the connection management service of the RIC from VMware.

If, for instance, the rApp discovers that a cell and its neighboring cell both share a PCI value of 243. To resolve the conflict, the rApp changes the cell's physical cell identifier to 84.

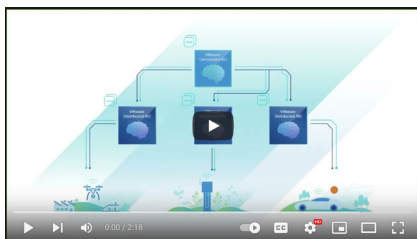
Benefits

By using the P.I. Works PCI Optimizer rApp, CSPs can eliminate PCI conflicts, difficulties in attaching to a network, and other issues that result in dropped calls or poor subscriber experiences.

The rApp protects against the introduction of new errors as CSPs move to a fast-paced rollout of their 5G networks.

RAN PROGRAMMABILITY

The RAN intelligent controller gives applications from different vendors access to the functions running in the control and management planes of your radio access network, empowering you to program and optimize your RAN by using methods like artificial intelligence and machine learning.



Demo Video: Activating Network Programmability with VMware RIC

VMWARE RIC AT A GLANCE

VMware RIC lets you programmatically manage and control your radio access network (RAN). The RAN intelligent controllers from VMware enable third-party application developers to tap into network data, process it, and use it to modify RAN behavior.

VMware Distributed RIC hosts near-real-time applications (xApps), and VMware Centralized RIC runs non-real-time applications (rApps). These apps introduce new use cases — automation, optimization, and service customization — that fuel innovation across a telecommunications network.

KEY BENEFITS

- **Multi-vendor interoperability and a vibrant partner ecosystem** – use a vendor- and technology-agnostic platform and tap pioneering solutions.
- **Network optimization** – gain network-wide observability and automate optimization with AI/ML.
- **Efficiency** – reduce energy consumption and improve spectrum utilization by using applications from various partners.

RIC SDK PARTNER PROGRAM

A rich developer ecosystem is critical to the successful adoption of open RAN technology. The VMware RIC SDK Partner Program expands access to and simplifies the development of RIC applications. The program gives partners access to RIC SDKs as well as training videos and application developer support. To find out more, visit

<https://techpartnerhub.vmware.com/programs/vmware-ric>

LEARN MORE

For more information about the VMware Telco Cloud or VMware RIC, call 1-877-VMWARE (outside North America, dial +1-650-427-5000) or visit <https://telco.vmware.com/>

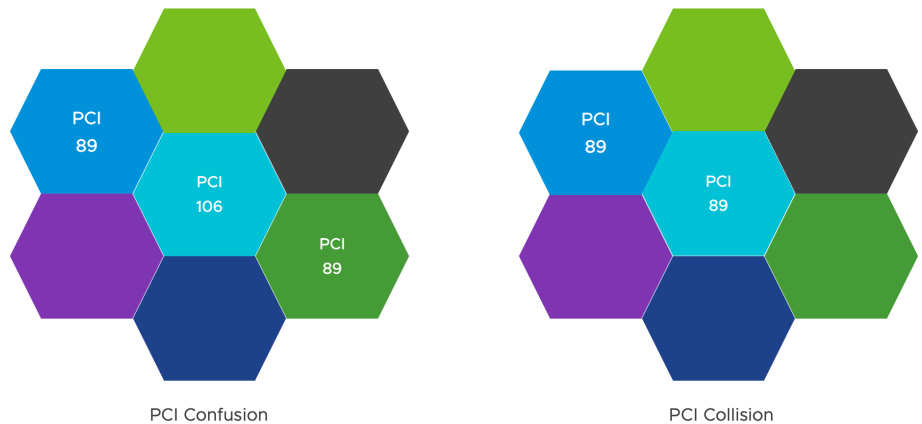


FIGURE 3: The PCI Optimizer rApp from P.I. Works detects and resolves physical cell ID confusion and collisions.

VMware and the Path to a Disaggregated, Programmable RAN

For the past five years, VMware has been methodically introducing new telco cloud solutions and changing expectations in the service provider industry about modernization. With an established footprint in telco cloud deployments globally, VMware has been expanding its capabilities to address the challenges in the disaggregation of the RAN.

With a horizontal platform that enables workload consistency from the core and the RAN to the public cloud, we've revealed what is possible—simplicity, speed, agility, and far-reaching automation. The objective is to enable our customers to modernize their entire networks, simplify their operations with end-to-end consistency, and further disaggregate their RAN.