DemandFlow RAN Digital Twin

DEMANDFLOW®

Towers, antennas, radios, cells, spectrum and KPIs in one model, from the mount point to the neighbour list

DATA SHEET

A radio network is described in at least four places: the tower records a structural engineer trusts, the antenna schedule the riggers work from, the planning tool's cell parameters and the OSS that runs the live network. They drift apart within months. When a sector underperforms, a tenant asks for space or an upgrade is proposed, someone reconciles them by hand.

DemandFlow® keeps the passive and the logical RAN in one model and joins them at the sector. An antenna knows its mount point, its face, its height, its tenant and the cells it serves. A cell knows its radio, its RF connections, its antenna, its fronthaul strand, its neighbours, its licence and ninety days of KPIs. The same records feed the elevation drawing, the map, the site pack, the capacity forecast and the rollout board.

What it is

A digital twin of the access network for mobile operators, neutral hosts and tower companies: the tower hierarchy (tower, section, face, mount point), the equipment on it (antennas, radio units, dishes, RF connections, RAD centres), the logical RAN (nodes, sectors, cells, neighbours, configuration snapshots, daily KPIs), spectrum licences, EMF assessments, structural analyses, site power and energy, and the planning layer of search rings, candidates and rollout programmes. Import from Ericsson ENM, Nokia NetAct, OSS CSV or Atoll, and read it back through REST and MCP.

It sits inside DemandFlow, so a cell rides on a backhaul link that the logical network already models, a site upgrade is checked against the site's power budget, a planned change to a source site warns the sensing customers it affects, and a new site runs through the same work order, procurement and finance records as everything else.

What an operator gets

- **One tower drawing that is always current.** Elevation and plan views drawn from the records: every antenna, radio and dish at its real height per face, coloured by tenant, with free positions marked. Download the A3 site pack.
- **Cells traced to the antenna.** Cell to radio to RF connection to antenna to fronthaul strand, with every gap in the chain stated.
- **The map that shows the network.** Sites, towers and sector wedges by technology and band, neighbour lines for a chosen cell, EMF zones, search rings, candidates and live alarms.
- **Neighbours and PCI checked.** One-way and missing neighbours, PCI collision and confusion with a re-plan suggestion, TAC boundaries and golden parameter audits as a worklist.
- **Spectrum under control.** Licences with band, block, area and dates; cells outside their licence, unused holdings and expiries within twelve months flagged.
- **Capacity before it bites.** Cells forecast to pass 80 per cent PRB in three, six or twelve months, with a remedy that only names bands you hold.
- **Upgrades answered in one screen.** Propose radios and carriers and get a yes or no on power and backhaul headroom, with the reason.
- **Rollout from ring to on air.** Search rings, ranked candidates, a programme board from acquisition to acceptance and a gantt of actual against target.

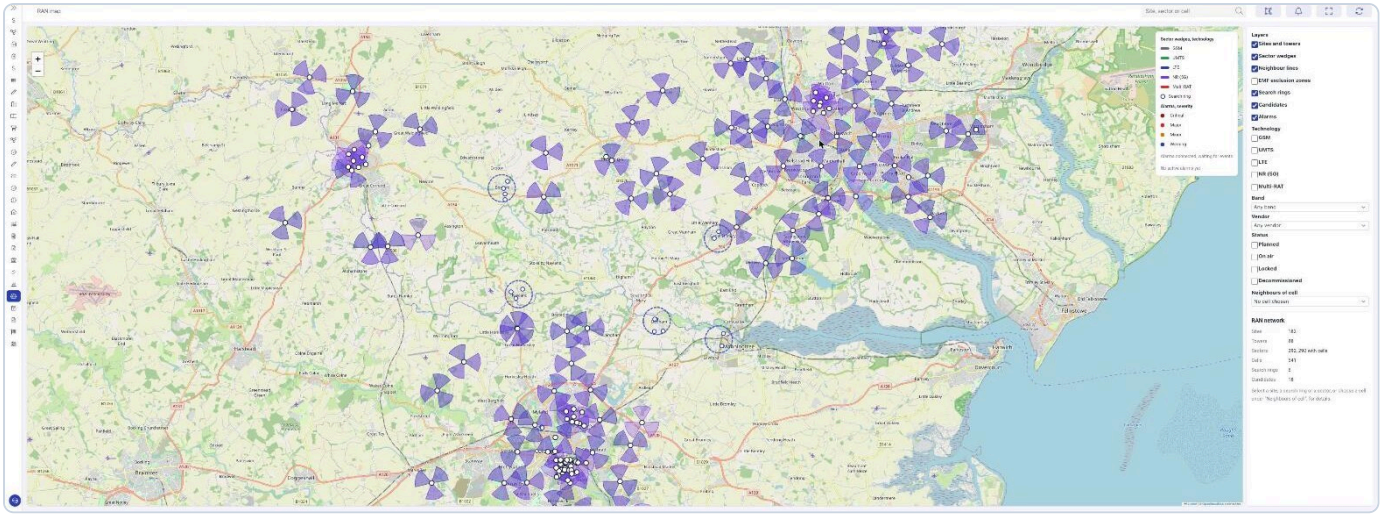

FIGURE 1. THE RAN MAP: 88 MACRO TOWERS AND 28 SMALL CELLS, SECTOR WEDGES BY TECHNOLOGY, SEARCH RINGS AND CANDIDATES, WITH LAYER, TECHNOLOGY, BAND, VENDOR AND STATUS FILTERS

The passive network

A tower is modelled as sections, faces and mount points, each mount point with its height, azimuth and status (available, reserved, in service, faulty, planned, removed). Antennas, radio units and dishes attach to mount points; an antenna records height above ground, azimuth, mechanical and electrical tilt, RET identity, model, tenancy and the sector it serves. Antenna and equipment models are catalogue items with bands, ports, gain, beamwidths, tilt range, dimensions, weight, wind area and data sheet.

The elevation and plan view is drawn from these records, not kept as a separate drawing. Overlapping items are laid out in lanes, RAD centres are marked, the plan view shows beam wedges, colour means tenant and shape means status. Structural analyses and EMF assessments hang off the tower, and the site pack PDF gathers the drawing, equipment schedule, tenancies, lease, RAD centres and the latest structural and EMF documents on A3.

Layer	Records
Structure	Towers, sections, faces, mount points, mounted equipment, RAD centres, structural analyses, EMF assessments and zones
Equipment	Antenna models, antennas, radio units, equipment models, RF connections, tenancies
Logical RAN	RAN nodes, sectors, cells, neighbours, cell configuration snapshots, daily cell KPIs, golden parameters, sector designs
Spectrum	Spectrum licences with band, block, bandwidth, duplex, area polygon, dates and fee
Site power	Power systems (grid, rectifiers, batteries, generator, solar), energy readings, tenant recharge
Planning	Search rings, site candidates, rollout programmes and programme sites, OSS import runs

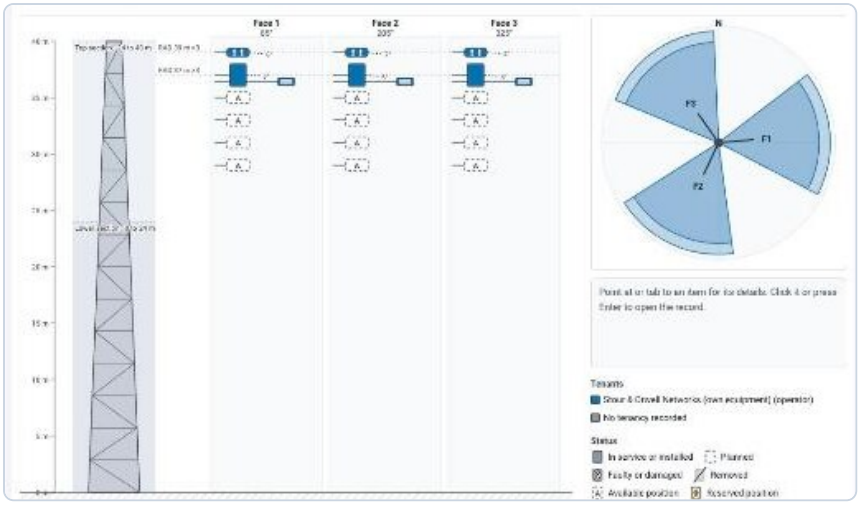

FIGURE 2. A 40 M LATTICE TOWER: THREE FACES, ANTENNAS, RADIOS AND FREE POSITIONS AT REAL HEIGHT, THE PLAN VIEW WITH BEAM WEDGES, AND THE TENANT AND STATUS KEY

The logical RAN

A sector joins the two halves of the model. The site's Sectors panel shows a card per sector by azimuth with its antennas, radios and cells grouped by band and technology, and badges where a cell has no antenna or no radio. A cell carries cell id, global cell id, technology (GSM, UMTS, LTE, NR or multi-RAT), node, sector, band, duplex, channel, bandwidth, PCI, TAC, maximum power, MIMO, licence and status. RF port rules are enforced on save.

Cell Trace follows the cell to its radio, through each RF connection with its loss, to the antenna, and on to the fronthaul strand in the fibre layer, stating every break in the chain. Configuration snapshots keep parameter diffs over time. The KPI panel shows ninety days of availability, PRB utilisation, traffic and users as tiles against a thirty-day baseline, with the daily table beneath.

Neighbours. Relations are directed, typed (intra-frequency, inter-frequency, inter-RAT) and sourced (planned, ANR or imported), and drawn on the map. Checks find one-way relations, missing neighbours between co-sited cells or cells within 5 km facing within 30 degrees, and lists past the vendor limit of 32.

PCI and TAC. PCI collision and confusion are detected with a re-plan suggestion in the range 0 to 503; TAC boundaries and golden parameter deviations are audited. Findings land in a RAN checks worklist with acknowledge and suppress.

Antenna performance. An antenna is ringed on the elevation when its sector's drop rate has doubled for seven days against a 28-day baseline with no configuration change, and one click raises an inspection with the evidence attached.

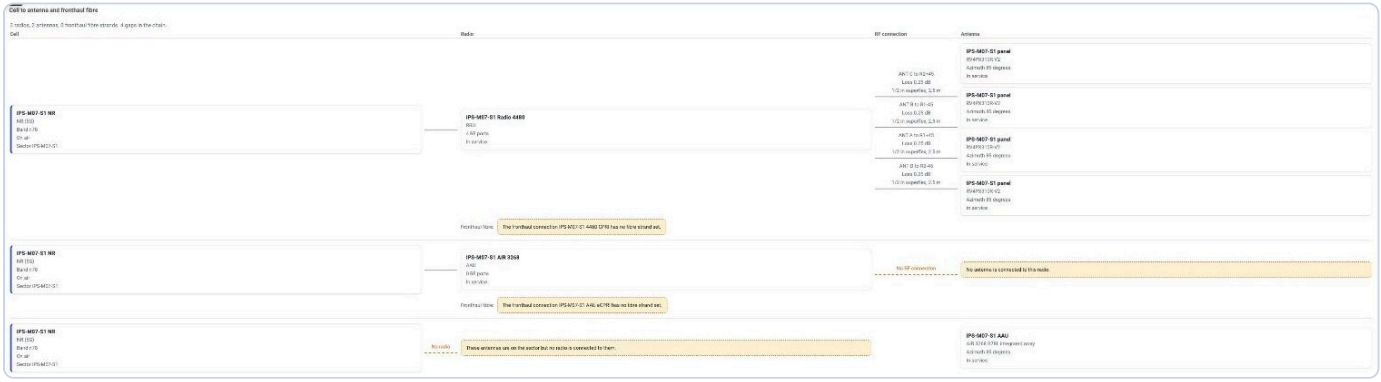

FIGURE 3. CELL TRACE FOR AN N78 CELL: THE RADIO, FOUR RF CONNECTIONS WITH THEIR LOSS, THE PANEL ANTENNA AND THE AAU, WITH THE FRONTHAUL GAPS STATED

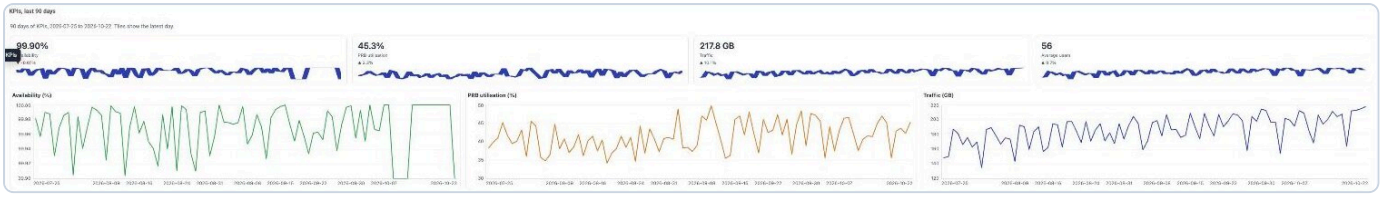

FIGURE 4. NINETY DAYS OF CELL KPIS: AVAILABILITY, PRB UTILISATION, TRAFFIC AND AVERAGE USERS AGAINST THE BASELINE

Spectrum, coverage and capacity

Spectrum licences record regulator, reference, band, block, bandwidth, duplex, technology neutrality, area polygon, dates, fee, status and the licence document. Three checks run against the cells: a cell outside its licence by frequency or area, a holding with no cells on it, and a licence expiring within twelve months. LTE bands 1, 3, 7, 8, 20, 28, 38 and 40 and NR bands n1 to n258 are catalogued.

The Coverage panel imports a prediction from your planning tool as GeoJSON, KML or KMZ, tagged by technology, band and threshold, and keeps it as a versioned spatial dataset. Draw a target polygon and the gaps are reported in square kilometres; a gap opens a new search ring. Sector wedges on the map are nominal reach by band, not propagation.

Capacity. Cells forecast to pass 80 per cent PRB within three, six or twelve months, by linear or seasonal-naive projection over the KPI history. The remedy is ranked: add a carrier on a held band with at least 5 MHz free (up to four carriers), else split the sector, else a new site. It never names a band you do not hold.

Upgrade readiness. On any site, propose radios and new carriers with their peak throughput and extra watts. Power headroom comes from the tower's power budget and backhaul headroom from the site's links and circuits; the answer is yes or no with the reason, and nothing is saved.

Network replay. A 3D map replays the network hour by hour with sectors coloured and raised by traffic, PRB, availability or uplink noise, alongside incidents and customers offline.

Rollout, energy and live operations

A search ring is a purpose with a centre and radius or a polygon. Candidates are ranked on coverage, cost and planning (weighted 0.5, 0.25 and 0.25), and starting acquisition creates a programme site. The rollout board moves a site through acquisition, planning, design, structural, power, backhaul, build, integration, on air and acceptance; dragging a card saves it, On air sets the cells live, and a gantt compares actual with target dates.

Energy readings per site record grid kWh, generator litres, solar, cost and a carbon factor, giving kgCO2e; readings can be allocated to tenants with recharge proposals. Live alarms from a feed are matched to cell, node or sector and shown on the map; Raise incident captures the affected cells and an estimate of customers from average users.

Import. The wizard reads Ericsson ENM bulk CM XML, Nokia NetAct RAML XML, OSS CSV and Atoll plans, previews new, updated and unmatched records on tiles, grids and the map, then applies them as nodes, cells, configuration diffs and neighbours with an import run record.

Read it back. REST gives a site or a cell as one bundle; MCP exposes ran_site and ran_cell read-only, tenant-scoped and audited, so an assistant or an operations script can ask what is on a tower or behind a cell.

Sensing. A gNB cell registered as a sensing source links its site, antenna, node and network function, and its footprint follows the antenna azimuth.

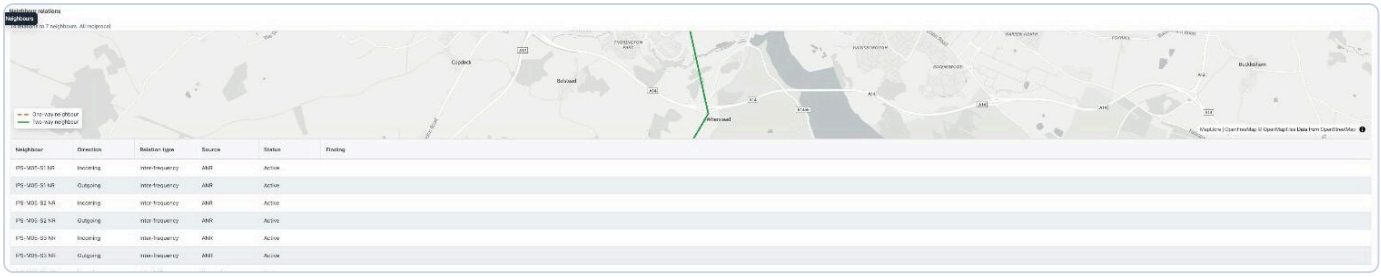

FIGURE 5. NEIGHBOUR RELATIONS FOR A CELL ON THE MAP AND IN THE GRID: DIRECTION, TYPE, SOURCE AND STATUS, WITH FINDINGS ALONGSIDE

Summary of specifications

Item	Detail
Technologies and bands	GSM, UMTS, LTE, NR and multi-RAT; 700 to 26,000 MHz; LTE bands 1, 3, 7, 8, 20, 28, 38, 40; NR n1 to n258
Tower model	Tower, section, face, mount point; antennas, radio units, dishes and mounts with height, azimuth and tilts; RAD centres; tenancies; structural analyses; EMF assessments and zones
Drawings and packs	Elevation and plan view drawn from records; colour by tenant, status by shape; A3 site pack PDF (drawing, equipment schedule, tenancies, lease, RAD centres, latest structural and EMF)
Logical RAN	Nodes, sectors, cells (cell id, global cell id, band, duplex, channel, bandwidth, PCI, TAC, power, MIMO, licence); configuration snapshots with diffs; 90-day KPI panel; 400 days of daily KPIs
Trace	Cell to radio to RF connections (with loss) to antenna to fronthaul strand; breaks stated; RF port rules on save
Neighbour and PCI checks	One-way and missing (co-sited or within 5 km facing within 30 degrees); vendor limit 32; PCI collision and confusion with re-plan 0 to 503; TAC boundary; golden parameter audit; worklist with acknowledge and suppress
Spectrum	Licences with regulator, band, block, bandwidth, duplex, area polygon, dates, fee; cell outside licence, unused holding, expiry within 12 months
Map and coverage	Sites, towers, sector wedges by technology and lowest band, neighbour lines, EMF zones, search rings, candidates, alarms; coverage import GeoJSON, KML, KMZ as versioned datasets; gap report in km2
Capacity and upgrades	80 per cent PRB forecast at 3, 6 and 12 months (linear, seasonal-naive); remedy add carrier (5 MHz free, max 4), split sector, new site; upgrade readiness on power and backhaul headroom
Rollout	Search rings; candidates ranked 0.5 coverage, 0.25 cost, 0.25 planning; programme board acquisition to acceptance; gantt actual vs target
Energy and alarms	Grid kWh, generator litres, solar, cost, kgCO2e per site; tenant recharge proposals; alarm feed matched to cell, node and sector; incidents with estimated customers
Import and API	Ericsson ENM bulk CM XML, Nokia NetAct RAML, OSS CSV, Atoll; preview then apply; REST /v1/ran/sites and /v1/ran/cells; MCP ran_site and ran_cell, read-only and audited

www.demandflow.com
Book a demo: www.demandflow.com/telco-network-management/

DemandFlow® is a registered trademark of TOCLOCO LTD. Registered in England No. 09950859. 71-75 Shelton St, London, WC2H 9JQ. © TOCLOCO LTD. All rights reserved.