**Radiology Scheduler — Consolidated Requirements & MVP Technical Spec**

Next.js + Postgres + NextAuth | Two-Month Generator | Config-Driven

Prepared: August 13, 2025

# 1. Sources Included

This document consolidates all details you provided, including:

* Original feature list (1–18) describing scheduling, vacations, subspecialties, swaps, summaries, fellows, calendar sync, and subscriptions.
* June schedule workbook structure and sample notations (initials, +late, \*(INR call), rds).
* Full transcript from July 16, 2025 (verbatim) and the follow‑up clarifications (MA1 eligibility, equivalence, vacation policy, FTE/PT).

# 2. Roles & Access

### Roles

|  |  |
| --- | --- |
| Role | Capabilities |
| Super Admin | Manages tenants/orgs; global visibility; cannot access clinical data outside governance. |
| Admin | Configures org (timezone, week start, subspecialties, shift types, eligibility, vacation policy); imports roster; runs generator; publishes. |
| Chief | Operational lead; can approve exceptions (e.g., extended consecutive vacations), review drafts, publish; cannot delete org. |
| Radiologist | Completes profile, submits monthly ranked vacation weeks, views personal schedule. |

# 3. Original Feature List (Verbatim, structured)

1. 1) Automated shift scheduling for 30+ users across 20–30 shifts.
2. 2) Schedule generated for the entire year in advance.
3. 3) Before schedule: each user enters preferred vacation weeks with constraints (max one week off per month). Can break a rule with chief approval (e.g., 4 weeks in a row).
4. 4) Group divided into subspecialties. Most shifts are subspecialized and restricted (e.g., N1 neurorads only).
5. 5) Some shifts can be done by any radiologist.
6. 6) Some shifts can only be done by certain named radiologists (e.g., MA1 irrespective of subspecialty).
7. 7) Dollar values per shift, tallied monthly and yearly (e.g., weekend call paid).
8. 8) Different FTEs (60–100%) affect work pattern (e.g., 100%≈3 weeks/month + 1 vacation; 50%≈1.5 weeks + 1.5 weeks off + vacation).
9. 9) Even distribution across the year for each type per eligible rad (e.g., each neurorad gets same number of N1, N2…).
10. 10) Monthly summaries per rad for bookkeeper (e.g., Euan Zhang worked 3×N1, 2×N2, 1×weekend call, 2×night).
11. 11) Fellows have their own vacations, shifts, and calls.
12. 12) Ability to accommodate several fellows.
13. 13) Shift swaps: requester selects targets; owners receive emails; once one approves, others are told request filled.
14. 14) Giveaways: certain shifts (e.g., weekend call) can be given away; most others are swap‑only.
15. 15) Away status per user/date to prevent being targeted for swaps on those dates.
16. 16) Master calendar, mobile‑responsive (app not required).
17. 17) One‑way Google Calendar sync per user.
18. 18) Subscriptions either per user or per group (TBD).

# 4. Subspecialties & Shift Rules (From Your Notes)

### Shift Eligibility Map

|  |  |
| --- | --- |
| Shift/Category | Eligibility |
| Neuro 1–4 | Neuroradiology only |
| Vascular | IR only (interventional radiology) |
| General X‑ray | Anyone (commonly covered by Body) |
| CT/Ultrasound | Body only |
| MSK | Body only |
| Body Volume Support | Body only |
| Body MRI | Body only |
| Clinic Sites (Stoney Creek, MA1, Speers, Walker’s Line, WH other, Brant) | Anyone (but MA1 may be named‑only) |
| Coiling | INR (interventional neuro) only; currently one person |
| Cardiac CT/MRI | Chest only |
| Late blocks (Body/Neuro 16–18, 18–21) | Subspecialty‑specific as named |

# 5. Vacation Policy & Intake

Quota: by design, each radiologist selects \*\*one vacation week per calendar month\*\* (12/year). Exceptions (e.g., 3–4 in a row) require chief approval.

Intake timing: prior year (e.g., Nov–Dec) for the following year; invitations, reminders, and a lock date per month.

Submission: for each month, the user submits up to \*\*3 ranked week options\*\* (1st, 2nd, 3rd).

Resolution: engine tries 1st choices; collisions resolved by a \*\*fairness ledger\*\* (then seeded random). Users who lose a tie get priority in subsequent months.

Fairness scoring (default): 1st=+0, 2nd=+1, 3rd=+2, none=+3. When a tie‑break helps you win, your score decays by 1 next month.

Consecutive week rule (default): allow up to two instances of 2 weeks back‑to‑back per year; longer runs require chief approval.

# 6. FTE & PT Days (Dynamic, Ontario-style framing)

Scheduling uses your \*\*internal FTE→PT policy\*\* (not statutory ESA minimums). We store the policy at the org level and compute each member’s monthly PT day allowance.

Recommended banding (editable at setup):

### Suggested FTE→PT Mapping

|  |  |
| --- | --- |
| Band | PT Days / Month |
| 60–69% FTE | 8 PT days/month |
| 70–79% FTE | 6 PT days/month |
| 80–89% FTE | 4 PT days/month |
| 90–99% FTE | 2 PT days/month |
| 100% FTE | 0 PT days/month |

Weekday balance cap (default): Mon or Fri PT cannot exceed any other weekday by more than 1 within a month (prevents 'every Friday off').

MVP toggle: store policy now; optionally enable auto‑assignment of PT days later to block availability during generation.

# 7. Equivalence (MVP, swaps only)

Generation stays exact by shift type. Equivalence is for swaps only, always obeying eligibility and time window.

### Proposed MVP Equivalence Groups

|  |  |
| --- | --- |
| Group Code | Members |
| NEURO\_DAY\_EQ1 | Neuro 1, Neuro 2, Neuro 3, Neuro 4 |
| NEURO\_LATE\_EQ1 | Neuro 1600–1800, Neuro 1800–2100 |
| BODY\_LATE\_EQ1 | Body 1600–1800, Body 1800–2100 |
| CLINIC\_EQ1 | Stoney Creek, Speers, Walker’s Line, WH other, Brant (Mammo) |
| CLINIC\_EQ\_MA1 | MA1 (if named‑only, keep separate; else fold into CLINIC\_EQ1) |

Excluded from equivalence (specialized): Coiling (INR), Cardiac CT/MRI (Chest), Vascular (IR), and distinct Body modalities (CT/US, MSK, Body MRI, Body Volume Support).

# 8. Swaps, Giveaways, Away

Swaps: requester selects one or many targets; system offers sequentially to avoid spamming; approval required by the other party; eligibility must hold; equivalence applies if configured.

Giveaways: limited to explicitly marked shift types (default: weekend call); system offers sequentially to eligible pool.

Away: prevents receiving swap/giveaway requests on specified dates (hard block).

# 9. Calendars, Emails, Reporting

Calendars: Master calendar and My Schedule; mobile‑responsive. One‑way Google Calendar sync is deferred beyond MVP.

Emails: Invites for vacation intake, reminders pre‑lock, publish notices. Logged for audit.

Reporting: monthly CSV per user (Date, Shift, Site, Start, End, $Value, Subspecialty, Notes) plus group totals and YTD. Dollar values default to $0 except a single Weekend Call rate until table is provided.

# 10. MVP Scope vs Later

### Scope Summary

|  |  |
| --- | --- |
| Feature | Phase |
| Auth & RBAC | MVP |
| Org setup (timezone, subspecialties, shift types, eligibility, vacation policy) | MVP |
| Roster import & invites | MVP |
| Vacation intake (ranked) & lock | MVP |
| Two‑month generator (eligibility + fairness) | MVP |
| Publish & email notifications | MVP |
| Master + My calendar; CSV export; audit | MVP |
| Swaps (basic, same type; optional equivalence groups) | Later (v1) |
| Giveaways | Later (v1) |
| PT day auto‑assignment & weekday balance enforcement | Later (v1) |
| Google Calendar push | Later (v1) |
| Dollar values & payouts, PDF reports | Later (v1) |
| OR‑Tools optimizer & AI linting | Later (v1.5+) |
| Billing | Later (v1) |

# 11. Open Questions & Defaults

### Unknowns & Defaults

|  |  |  |  |
| --- | --- | --- | --- |
| Topic | Decision Needed | Default Now | Why |
| Dollar values per shift | Provide values & premiums | Default $0; single Weekend Call rate | Needed for payouts |
| Giveaway‑eligible list | Confirm list | Weekend call only | Aligns w/ current practice |
| MA1 eligibility | Provide named list if restricted | Treat as 'Any' until list provided | Tighten later w/o code changes |
| Coiling coverage | Name INR person & backup | Assume single named; warn on conflicts | Avoids unfilled days |
| FTE→PT mapping | Confirm bands or formula | Suggested bands (8/6/4/2/0) | Dynamic and transparent |
| PT weekday cap | Confirm strictness | ±1 cap | Prevents Fri/Mo bias |
| Equivalence sets | Confirm groups | Use proposed groups | Swaps only |
| Rest/sequence caps | Provide numbers | None (engine avoids stacks) | Add later as constraints |
| Holidays | Provide rules | Ontario stats; no premium | Easy to update |
| Coverage exceptions | List allowed gaps | None | Full coverage required |
| Fellows | Provide names & rules | None for MVP | Add later |
| Initials & flags | Map initials; define \*, +late, rds | Treat as notes only | No logic impact until defined |

# 12. Data Model (Postgres)

### Schema Summary

|  |  |
| --- | --- |
| Table | Columns (summary) |
| orgs | id, name, timezone, week\_start, created\_at |
| users | id, email, name, created\_at |
| memberships | id, org\_id, user\_id, role[SUPER\_ADMIN|ADMIN|CHIEF|RAD], subspecialty\_id NULL, is\_active |
| subspecialties | id, org\_id, code, name, is\_active |
| shift\_types | id, org\_id, code, name, start\_time, end\_time, recur\_mon..recur\_sun BOOL, required\_subspecialty\_id NULL, allow\_any BOOL, is\_active |
| shift\_named\_eligibility | id, org\_id, shift\_type\_id, member\_id |
| vacation\_policy | org\_id PK, weeks\_per\_month INT, ranked\_options INT, max\_consecutive\_weeks INT |
| vacation\_prefs | id, org\_id, member\_id, year INT, month INT, week\_index INT, rank INT |
| vacation\_lock | org\_id, year, month, locked BOOL |
| shift\_instances | id, org\_id, date DATE, shift\_type\_id, UNIQUE(org\_id, date, shift\_type\_id) |
| assignments | id, org\_id, shift\_instance\_id, member\_id, status[draft|published], created\_at |
| fairness\_ledger | id, org\_id, member\_id, year INT, month INT, delta INT, reason TEXT |
| audit\_log | id, org\_id, actor\_id, action, entity, entity\_id, before JSONB, after JSONB, created\_at |
| email\_log | id, org\_id, member\_id, template, status, meta JSONB, sent\_at |

# 13. API Contracts (REST)

### MVP Endpoints

|  |  |
| --- | --- |
| Endpoint | Contract |
| POST /api/admin/orgs | {name, timezone, weekStart} → {orgId} |
| POST /api/subspecialties | [{code, name}] |
| POST /api/shift-types | [{code, name, start, end, recur:{mon..sun}, requiredSubspecialtyId|null, allowAny}] |
| POST /api/shift-types/{id}/named-eligibility | [{memberId}] |
| PUT /api/vacation-policy | {weeksPerMonth, rankedOptions, maxConsecutiveWeeks} |
| POST /api/members/import | [{name, email, subspecialtyCode, role}] |
| GET /api/members | List members |
| POST /api/vacation/invite | {monthRange:[{year,month}]} |
| POST /api/vacation/prefs | {year, month, weeks:[{weekIndex, rank}]} // user |
| POST /api/vacation/lock | {year, month, locked:true} |
| POST /api/instances/generate | {from:{y,m}, to:{y,m}} |
| POST /api/schedule/generate | {year, month} |
| POST /api/schedule/publish | {year, month} |
| GET /api/export/schedule.csv | year, month query params |

# 14. UI Routes & Key Screens

### Routes

|  |  |
| --- | --- |
| Path | Purpose |
| /login | NextAuth magic-link login |
| / | Role‑aware dashboard |
| /org/setup | Wizard: subspecialties → shift types → eligibility → vacation policy → generate instances |
| /org/roster | Roster table & CSV import |
| /vacation | Radiologist picker for ranked weeks (next 2 months) |
| /vacation/manage | Admin: submission progress, reminders, lock |
| /schedule/generate | Admin: run generator, review draft, publish |
| /calendar/master | Master calendar with filters |
| /calendar/me | Personal calendar |
| /export | CSV exports |
| /audit | Audit log |

# 15. Scheduling Engine (MVP Heuristic)

Inputs: shift instances, roster (with subspecialties), shift eligibility (required/named/any), vacation prefs, vacation policy.

Steps per month:

1. 1) Resolve vacations with fairness scoring; record deltas (+0/+1/+2/+3).
2. 2) Compute availability (vacation‑blocked days).
3. 3) For each shift instance: build eligible pool → prefer lowest count of that shift type in the window → then lowest total assignments → then fairness score → seeded random.
4. 4) Repair pass flags empty pools (admin override required).
5. 5) Deterministic seed is logged for reproducibility.

# 16. Validation, Testing, Acceptance

Validation: prevent duplicate vacation ranks; enforce eligibility precedence; unique (org\_id, date, shift\_type\_id).

Unit: vacation resolver, eligibility filter, assignment selection. Integration: full flow org→setup→roster→invite→prefs→lock→generate→publish→export.

Acceptance: admin can fully generate and publish 2 months, emails are sent, calendars render, CSV exports download, audit logs present.

# 17. Milestones

### Suggested Timeline

|  |  |
| --- | --- |
| Milestone | Scope |
| M0 | Setup/Auth (0.5–1w) |
| M1 | Org & Catalog (1w) |
| M2 | Roster & Intake (1w) |
| M3 | Engine & Publish (1–1.5w) |
| M4 | Polish & QA (0.5w) |