```typescript
import { Component, OnInit, signal, computed } from '@angular/core';
import { CommonModule } from '@angular/common';
import { ActivatedRoute, Router, RouterLink } from '@angular/router';
import { FormsModule } from '@angular/forms';
import { MainLayoutComponent } from '@shared/components/main-layout/main-
layout.component';
import { SoutenanceService } from '@core/services/soutenance.service';
import { Soutenance, StatutSoutenance, MembreJury, RoleJury, Prerequis } from
'@core/models/soutenance.model';

@Component({
    selector: 'app-soutenance-detail',
    standalone: true,
    imports: [CommonModule, MainLayoutComponent, FormsModule, RouterLink],
    template: `
    <app-main-layout>
      <div class="page-container p-4">

        <!-- LOADING STATE -->
        @if (isLoading()) {
          <div class="loading-container">
            <div class="spinner"></div>
            <p>Chargement des détails...</p>
          </div>
        }

        @else if (error()) {
          <div class="error-container">
            <div class="error-icon">
              <i class="bi bi-exclamation-triangle"></i>
            </div>
            <h3>Erreur de chargement</h3>
            <p>{{ error() }}</p>
            <button class="btn-back" (click)="goBack()">
              <i class="bi bi-arrow-left me-2"></i>Retour à la liste
            </button>
          </div>
        }

        @else if (soutenance()) {
          <!-- HEADER -->
          <div class="page-header" [class]="getHeaderClass()">
            <div class="header-top">
              <button class="btn-back-header" (click)="goBack()">
                <i class="bi bi-arrow-left"></i>
              </button>
              <div class="status-badge-large" [class]="getStatusBadgeClass()">
                <i class="bi" [class]="getStatusIcon()"></i>
                {{ formatStatut(soutenance()!.statut) }}
              </div>
            </div>
            <div class="header-content">
              <h1 class="page-title">Détails de la Soutenance</h1>
              <p class="page-subtitle">Soutenance #{{ soutenance()!.id }}</p>
            </div>
            <div class="header-meta">
              <span class="meta-item">
                <i class="bi bi-calendar3"></i>
                Créée le {{ soutenance()!.createdAt | date:'dd/MM/yyyy' }}
              </span>
              @if (soutenance()!.dateSoutenance) {
                <span class="meta-item">
                  <i class="bi bi-calendar-check"></i>
                  Prévue le {{ soutenance()!.dateSoutenance |
```

```html
date:'dd/MM/yyyy' }}
              </span>
            }
          </div>
        </div>

        <!-- MAIN CONTENT GRID -->
        <div class="content-grid">

          <!-- LEFT COLUMN -->
          <div class="left-column">

            <!-- DOCTORANT CARD -->
            <div class="detail-card">
              <div class="card-header-section">
                <div class="card-icon bg-primary">
                  <i class="bi bi-person-badge"></i>
                </div>
                <h3 class="card-title">Doctorant</h3>
              </div>
              <div class="card-body">
                <div class="profile-section">
                  <div class="avatar-large"
[style.background]="getAvatarColor(soutenance()!.doctorantId)">
                    {{ getInitials(soutenance()!.doctorantNom) }}
                  </div>
                  <div class="profile-info">
                    <h4 class="profile-name">{{ soutenance()!.doctorantNom ||
'Nom non disponible' }}</h4>
                    <span class="profile-id">
                      <i class="bi bi-hash me-1"></i>ID:
{{ soutenance()!.doctorantId }}
                    </span>
                  </div>
                </div>
              </div>
            </div>

            <!-- DIRECTEUR CARD -->
            <div class="detail-card">
              <div class="card-header-section">
                <div class="card-icon bg-success">
                  <i class="bi bi-person-video3"></i>
                </div>
                <h3 class="card-title">Directeur de Thèse</h3>
              </div>
              <div class="card-body">
                <div class="profile-section">
                  <div class="avatar-large bg-success-gradient">
                    {{ getInitials(soutenance()!.directeurNom) }}
                  </div>
                  <div class="profile-info">
                    <h4 class="profile-name">{{ soutenance()!.directeurNom ||
'Non assigné' }}</h4>
                    <span class="profile-id">
                      <i class="bi bi-hash me-1"></i>ID:
{{ soutenance()!.directeurId }}
                    </span>
                  </div>
                </div>
              </div>
            </div>

            <!-- SUJET DE THÈSE -->
```

```html
                <div class="detail-card">
                  <div class="card-header-section">
                    <div class="card-icon bg-info">
                      <i class="bi bi-journal-text"></i>
                    </div>
                    <h3 class="card-title">Sujet de Thèse</h3>
                  </div>
                  <div class="card-body">
                    <p class="these-text">{{ soutenance()!.sujetThese || 'Sujet
non défini' }}</p>
                  </div>
                </div>

                <!-- PRÉREQUIS -->
                <div class="detail-card">
                  <div class="card-header-section">
                    <div class="card-icon" [class.bg-success]="prerequisValides()"
[class.bg-warning]="!prerequisValides()">
                      <i class="bi" [class.bi-check-circle]="prerequisValides()"
[class.bi-exclamation-circle]="!prerequisValides()"></i>
                    </div>
                    <h3 class="card-title">Prérequis de Soutenance</h3>
                    <span class="card-badge" [class.badge-
success]="prerequisValides()" [class.badge-warning]="!prerequisValides()">
                      {{ prerequisValides() ? 'Validés' : 'En cours' }}
                    </span>
                  </div>
                  <div class="card-body">
                    @if (soutenance()!.prerequis) {
                      <div class="prerequis-grid">
                        <div class="prerequis-item"
[class.completed]="soutenance()!.prerequis!.nombreArticlesQ1Q2 >= 2">
                          <div class="prerequis-icon">
                            <i class="bi bi-journal-richtext"></i>
                          </div>
                          <div class="prerequis-info">
                            <span class="prerequis-label">Publications
Q1/Q2</span>
                            <span class="prerequis-
value">{{ soutenance()!.prerequis!.nombreArticlesQ1Q2 }} / 2</span>
                          </div>
                          <div class="prerequis-progress">
                            <div class="progress-bar" [style.width.
%]="Math.min(soutenance()!.prerequis!.nombreArticlesQ1Q2 / 2 * 100, 100)"></div>
                          </div>
                        </div>

                        <div class="prerequis-item"
[class.completed]="soutenance()!.prerequis!.nombreConferences >= 2">
                          <div class="prerequis-icon">
                            <i class="bi bi-mic"></i>
                          </div>
                          <div class="prerequis-info">
                            <span class="prerequis-label">Conférences</span>
                            <span class="prerequis-
value">{{ soutenance()!.prerequis!.nombreConferences }} / 2</span>
                          </div>
                          <div class="prerequis-progress">
                            <div class="progress-bar" [style.width.
%]="Math.min(soutenance()!.prerequis!.nombreConferences / 2 * 100, 100)"></div>
                          </div>
                        </div>

                        <div class="prerequis-item"
```

```html
            [class.completed]="soutenance()!.prerequis!.heuresFormation >= 200">
                        <div class="prerequis-icon">
                          <i class="bi bi-clock-history"></i>
                        </div>
                        <div class="prerequis-info">
                          <span class="prerequis-label">Heures de
Formation</span>
                          <span class="prerequis-
value">{{ soutenance()!.prerequis!.heuresFormation }} / 200h</span>
                        </div>
                        <div class="prerequis-progress">
                          <div class="progress-bar" [style.width.
%]="Math.min(soutenance()!.prerequis!.heuresFormation / 200 * 100, 100)"></div>
                        </div>
                      </div>
                    </div>
                  } @else {
                    <div class="empty-prerequis">
                      <i class="bi bi-info-circle"></i>
                      <p>Prérequis non encore soumis</p>
                    </div>
                  }
                </div>
              </div>

            </div>

            <!-- RIGHT COLUMN -->
            <div class="right-column">

              <!-- INFORMATIONS SOUTENANCE -->
              <div class="detail-card">
                <div class="card-header-section">
                  <div class="card-icon bg-purple">
                    <i class="bi bi-calendar-event"></i>
                  </div>
                  <h3 class="card-title">Informations de Soutenance</h3>
                </div>
                <div class="card-body">
                  <div class="info-grid">
                    <div class="info-item">
                      <span class="info-label">Date prévue</span>
                      <span class="info-value">
                        @if (soutenance()!.dateSoutenance) {
                          {{ soutenance()!.dateSoutenance | date:'EEEE dd MMMM
yyyy':'':'fr' }}
                        } @else {
                          <span class="text-muted">Non définie</span>
                        }
                      </span>
                    </div>
                    <div class="info-item">
                      <span class="info-label">Heure</span>
                      <span class="info-value">
                        {{ soutenance()!.heureSoutenance || 'Non définie' }}
                      </span>
                    </div>
                    <div class="info-item">
                      <span class="info-label">Lieu</span>
                      <span class="info-value">
                        {{ soutenance()!.lieuSoutenance || 'Non défini' }}
                      </span>
                    </div>
                    @if (soutenance()!.statut === StatutSoutenance.TERMINEE) {
```

```html
                    <div class="info-item highlight">
                      <span class="info-label">Mention obtenue</span>
                      <span class="info-value mention"
[class]="getMentionClass()">
                        {{ soutenance()!.mention || 'Non attribuée' }}
                        @if (soutenance()!.felicitationsJury) {
                          <span class="felicitations-badge">
                            <i class="bi bi-star-fill"></i> Félicitations du
jury
                          </span>
                        }
                      </span>
                    </div>
                  }
                </div>
              </div>
            </div>

            <!-- JURY -->
            <div class="detail-card">
              <div class="card-header-section">
                <div class="card-icon bg-orange">
                  <i class="bi bi-people"></i>
                </div>
                <h3 class="card-title">Composition du Jury</h3>
                <span class="card-count">{{ soutenance()!.jury?.length || 0 }}
membres</span>
              </div>
              <div class="card-body">
                @if (soutenance()!.jury && soutenance()!.jury.length > 0) {
                  <div class="jury-list">
                    @for (membre of soutenance()!.jury; track membre.id) {
                      <div class="jury-member"
[class]="getJuryRoleClass(membre.roleJury)">
                        <div class="member-avatar">
                          {{ getInitials(membre.nom + ' ' + membre.prenom) }}
                        </div>
                        <div class="member-info">
                          <h5 class="member-name">{{ membre.prenom }}
{{ membre.nom }}</h5>
                          <span class="member-
etablissement">{{ membre.etablissement }}</span>
                          <span class="member-email">
                            <i class="bi bi-envelope me-1"></i>{{ membre.email
}}
                          </span>
                        </div>
                        <div class="member-role">
                          <span class="role-
badge">{{ formatRoleJury(membre.roleJury) }}</span>
                          @if (membre.rapportRecu !== undefined) {
                            <span class="rapport-status"
[class.received]="membre.rapportRecu"
[class.favorable]="membre.rapportFavorable">
                              <i class="bi" [class.bi-check-circle-
fill]="membre.rapportRecu" [class.bi-hourglass-split]="!membre.rapportRecu"></i>
                              {{ membre.rapportRecu ? (membre.rapportFavorable
? 'Favorable' : 'Défavorable') : 'En attente' }}
                            </span>
                          }
                        </div>
                      </div>
                    }
                  </div>
```

```html
                            } @else {
                              <div class="empty-jury">
                                <i class="bi bi-people"></i>
                                <p>Aucun membre de jury assigné</p>
                                <span class="empty-hint">Le jury sera proposé par le
directeur de thèse</span>
                              </div>
                            }
                        </div>
                      </div>

                      <!-- TIMELINE / HISTORIQUE -->
                      <div class="detail-card">
                        <div class="card-header-section">
                          <div class="card-icon bg-teal">
                            <i class="bi bi-clock-history"></i>
                          </div>
                          <h3 class="card-title">Progression</h3>
                        </div>
                        <div class="card-body">
                          <div class="timeline">
                            <div class="timeline-item"
[class.completed]="isStepCompleted('BROUILLON')"
[class.active]="soutenance()!.statut === StatutSoutenance.BROUILLON">
                              <div class="timeline-marker"></div>
                              <div class="timeline-content">
                                <span class="timeline-title">Brouillon</span>
                                <span class="timeline-desc">Demande créée</span>
                              </div>
                            </div>
                            <div class="timeline-item"
[class.completed]="isStepCompleted('SOUMIS')"
[class.active]="soutenance()!.statut === StatutSoutenance.SOUMIS">
                              <div class="timeline-marker"></div>
                              <div class="timeline-content">
                                <span class="timeline-title">Soumis</span>
                                <span class="timeline-desc">En attente de
validation</span>
                              </div>
                            </div>
                            <div class="timeline-item"
[class.completed]="isStepCompleted('PREREQUIS_VALIDES')"
[class.active]="soutenance()!.statut === StatutSoutenance.PREREQUIS_VALIDES">
                              <div class="timeline-marker"></div>
                              <div class="timeline-content">
                                <span class="timeline-title">Prérequis validés</span>
                                <span class="timeline-desc">Conditions remplies</span>
                              </div>
                            </div>
                            <div class="timeline-item"
[class.completed]="isStepCompleted('JURY_PROPOSE')"
[class.active]="soutenance()!.statut === StatutSoutenance.JURY_PROPOSE">
                              <div class="timeline-marker"></div>
                              <div class="timeline-content">
                                <span class="timeline-title">Jury proposé</span>
                                <span class="timeline-desc">Composition à valider</span>
                              </div>
                            </div>
                            <div class="timeline-item"
[class.completed]="isStepCompleted('PLANIFIEE')"
[class.active]="soutenance()!.statut === StatutSoutenance.PLANIFIEE">
                              <div class="timeline-marker"></div>
                              <div class="timeline-content">
                                <span class="timeline-title">Planifiée</span>
```

```html
                <span class="timeline-desc">Date et lieu fixés</span>
              </div>
            </div>
            <div class="timeline-item"
[class.completed]="isStepCompleted('AUTORISEE')"
[class.active]="soutenance()!.statut === StatutSoutenance.AUTORISEE">
              <div class="timeline-marker"></div>
              <div class="timeline-content">
                <span class="timeline-title">Autorisée</span>
                <span class="timeline-desc">Soutenance peut avoir
lieu</span>
              </div>
            </div>
            <div class="timeline-item"
[class.completed]="isStepCompleted('TERMINEE')"
[class.active]="soutenance()!.statut === StatutSoutenance.TERMINEE">
              <div class="timeline-marker"></div>
              <div class="timeline-content">
                <span class="timeline-title">Terminée</span>
                <span class="timeline-desc">Thèse soutenue 🎓</span>
              </div>
            </div>
          </div>
        </div>
      </div>

    </div>

  </div>

  <!-- ACTIONS BAR -->
  <div class="actions-bar">
    <button class="btn-action btn-secondary" (click)="goBack()">
      <i class="bi bi-arrow-left me-2"></i>Retour à la liste
    </button>

    <div class="actions-right">
      @if (soutenance()!.statut === StatutSoutenance.SOUMIS) {
        <button class="btn-action btn-success"
(click)="validerPrerequis()">
          <i class="bi bi-check-lg me-2"></i>Valider les prérequis
        </button>
        <button class="btn-action btn-danger" (click)="rejeter()">
          <i class="bi bi-x-lg me-2"></i>Rejeter
        </button>
      }
      @if (soutenance()!.statut === StatutSoutenance.JURY_PROPOSE) {
        <button class="btn-action btn-primary" (click)="planifier()">
          <i class="bi bi-calendar-plus me-2"></i>Planifier la
soutenance
        </button>
      }
      @if (soutenance()!.statut === StatutSoutenance.PLANIFIEE) {
        <button class="btn-action btn-success" (click)="autoriser()">
          <i class="bi bi-check-circle me-2"></i>Autoriser la soutenance
        </button>
      }
      @if (soutenance()!.statut === StatutSoutenance.AUTORISEE) {
        <button class="btn-action btn-purple"
(click)="marquerTerminee()">
          <i class="bi bi-mortarboard me-2"></i>Marquer comme terminée
        </button>
      }
      @if (soutenance()!.statut === StatutSoutenance.TERMINEE) {
```

```
                <button class="btn-action btn-info" (click)="genererPV()">
                  <i class="bi bi-file-earmark-pdf me-2"></i>Générer le PV
                </button>
                <button class="btn-action btn-info"
(click)="genererAttestation()">
                  <i class="bi bi-award me-2"></i>Générer l'attestation
                </button>
              }
            </div>
          </div>
        }

      </div>
    </app-main-layout>
  `,
   styles: [`
   .page-container {
     max-width: 1400px;
     margin: 0 auto;
   }

   /* LOADING & ERROR */
   .loading-container,
   .error-container {
     display: flex;
     flex-direction: column;
     align-items: center;
     justify-content: center;
     min-height: 400px;
     background: white;
     border-radius: 20px;
     padding: 3rem;
   }

   .spinner {
     width: 48px;
     height: 48px;
     border: 4px solid #e2e8f0;
     border-top-color: #667eea;
     border-radius: 50%;
     animation: spin 0.8s linear infinite;
     margin-bottom: 1rem;
   }

   @keyframes spin {
     to { transform: rotate(360deg); }
   }

   .error-icon {
     width: 80px;
     height: 80px;
     background: #fee2e2;
     border-radius: 50%;
     display: flex;
     align-items: center;
     justify-content: center;
     margin-bottom: 1rem;
   }

   .error-icon i {
     font-size: 2.5rem;
     color: #dc2626;
   }
```

```css
.btn-back {
  margin-top: 1rem;
  padding: 0.75rem 1.5rem;
  background: #667eea;
  color: white;
  border: none;
  border-radius: 10px;
  font-weight: 600;
  cursor: pointer;
}

/* HEADER */
.page-header {
  border-radius: 24px;
  padding: 2rem;
  color: white;
  margin-bottom: 2rem;
  position: relative;
  overflow: hidden;
}

.page-header::before {
  content: '';
  position: absolute;
  top: -50%;
  right: -10%;
  width: 300px;
  height: 300px;
  background: rgba(255,255,255,0.1);
  border-radius: 50%;
}

.page-header.header-soumis {
  background: linear-gradient(135deg, #f59e0b 0%, #d97706 100%);
}

.page-header.header-valide {
  background: linear-gradient(135deg, #3b82f6 0%, #2563eb 100%);
}

.page-header.header-planifiee {
  background: linear-gradient(135deg, #10b981 0%, #059669 100%);
}

.page-header.header-terminee {
  background: linear-gradient(135deg, #8b5cf6 0%, #7c3aed 100%);
}

.page-header.header-rejetee {
  background: linear-gradient(135deg, #ef4444 0%, #dc2626 100%);
}

.page-header.header-default {
  background: linear-gradient(135deg, #667eea 0%, #764ba2 100%);
}

.header-top {
  display: flex;
  justify-content: space-between;
  align-items: center;
  margin-bottom: 1rem;
}

.btn-back-header {
```

```css
  width: 44px;
  height: 44px;
  border-radius: 12px;
  background: rgba(255,255,255,0.2);
  border: 1px solid rgba(255,255,255,0.3);
  color: white;
  cursor: pointer;
  display: flex;
  align-items: center;
  justify-content: center;
  font-size: 1.25rem;
  transition: all 0.2s;
}

.btn-back-header:hover {
  background: rgba(255,255,255,0.3);
  transform: translateX(-4px);
}

.status-badge-large {
  padding: 0.5rem 1.25rem;
  background: rgba(255,255,255,0.2);
  border-radius: 30px;
  font-weight: 700;
  display: flex;
  align-items: center;
  gap: 0.5rem;
}

.page-title {
  font-size: 2rem;
  font-weight: 800;
  margin: 0 0 0.5rem 0;
}

.page-subtitle {
  margin: 0;
  opacity: 0.9;
  font-size: 1.1rem;
}

.header-meta {
  display: flex;
  gap: 1.5rem;
  margin-top: 1.5rem;
}

.header-meta .meta-item {
  display: flex;
  align-items: center;
  gap: 0.5rem;
  opacity: 0.9;
}

/* CONTENT GRID */
.content-grid {
  display: grid;
  grid-template-columns: 1fr 1fr;
  gap: 1.5rem;
}

/* DETAIL CARDS */
.detail-card {
  background: white;
```

```css
      border-radius: 20px;
      padding: 1.5rem;
      box-shadow: 0 4px 20px rgba(0,0,0,0.05);
      border: 1px solid #e2e8f0;
    }

    .card-header-section {
      display: flex;
      align-items: center;
      gap: 1rem;
      margin-bottom: 1.25rem;
      padding-bottom: 1rem;
      border-bottom: 1px solid #f1f5f9;
    }

    .card-icon {
      width: 48px;
      height: 48px;
      border-radius: 14px;
      display: flex;
      align-items: center;
      justify-content: center;
      font-size: 1.25rem;
      color: white;
    }

    .card-icon.bg-primary { background: linear-gradient(135deg, #667eea 0%,
#764ba2 100%); }
    .card-icon.bg-success { background: linear-gradient(135deg, #10b981 0%,
#059669 100%); }
    .card-icon.bg-info { background: linear-gradient(135deg, #3b82f6 0%, #2563eb
100%); }
    .card-icon.bg-warning { background: linear-gradient(135deg, #f59e0b 0%,
#d97706 100%); }
    .card-icon.bg-purple { background: linear-gradient(135deg, #8b5cf6 0%,
#7c3aed 100%); }
    .card-icon.bg-orange { background: linear-gradient(135deg, #f97316 0%,
#ea580c 100%); }
    .card-icon.bg-teal { background: linear-gradient(135deg, #14b8a6 0%, #0d9488
100%); }

    .card-title {
      font-size: 1.1rem;
      font-weight: 700;
      color: #1e293b;
      margin: 0;
      flex: 1;
    }

    .card-badge {
      padding: 0.25rem 0.75rem;
      border-radius: 20px;
      font-size: 0.75rem;
      font-weight: 600;
    }

    .card-badge.badge-success { background: #dcfce7; color: #16a34a; }
    .card-badge.badge-warning { background: #fef3c7; color: #d97706; }

    .card-count {
      font-size: 0.85rem;
      color: #64748b;
      font-weight: 600;
    }
```

```css
/* PROFILE SECTION */
.profile-section {
  display: flex;
  align-items: center;
  gap: 1rem;
}

.avatar-large {
  width: 64px;
  height: 64px;
  border-radius: 16px;
  display: flex;
  align-items: center;
  justify-content: center;
  color: white;
  font-weight: 700;
  font-size: 1.5rem;
  flex-shrink: 0;
}

.bg-success-gradient {
  background: linear-gradient(135deg, #10b981 0%, #059669 100%);
}

.profile-name {
  font-size: 1.1rem;
  font-weight: 700;
  color: #1e293b;
  margin: 0 0 0.25rem 0;
}

.profile-id {
  font-size: 0.85rem;
  color: #64748b;
}

/* THESE TEXT */
.these-text {
  font-size: 1rem;
  line-height: 1.7;
  color: #334155;
  margin: 0;
}

/* PREREQUIS GRID */
.prerequis-grid {
  display: flex;
  flex-direction: column;
  gap: 1rem;
}

.prerequis-item {
  display: grid;
  grid-template-columns: 48px 1fr;
  gap: 1rem;
  align-items: center;
  padding: 1rem;
  background: #f8fafc;
  border-radius: 12px;
  position: relative;
}

.prerequis-item.completed {
```

```css
    background: #f0fdf4;
  }

  .prerequis-item.completed .prerequis-icon {
    background: #dcfce7;
    color: #16a34a;
  }

  .prerequis-icon {
    width: 48px;
    height: 48px;
    border-radius: 12px;
    background: #e2e8f0;
    color: #64748b;
    display: flex;
    align-items: center;
    justify-content: center;
    font-size: 1.25rem;
  }

  .prerequis-label {
    font-size: 0.85rem;
    color: #64748b;
    display: block;
  }

  .prerequis-value {
    font-size: 1rem;
    font-weight: 700;
    color: #1e293b;
  }

  .prerequis-progress {
    grid-column: span 2;
    height: 6px;
    background: #e2e8f0;
    border-radius: 3px;
    overflow: hidden;
    margin-top: 0.5rem;
  }

  .prerequis-progress .progress-bar {
    height: 100%;
    background: linear-gradient(90deg, #10b981, #059669);
    border-radius: 3px;
    transition: width 0.3s;
  }

  .empty-prerequis {
    text-align: center;
    padding: 2rem;
    color: #64748b;
  }

  .empty-prerequis i {
    font-size: 2rem;
    margin-bottom: 0.5rem;
  }

  /* INFO GRID */
  .info-grid {
    display: flex;
    flex-direction: column;
    gap: 1rem;
```

```css
}

.info-item {
  display: flex;
  justify-content: space-between;
  align-items: center;
  padding: 1rem;
  background: #f8fafc;
  border-radius: 12px;
}

.info-item.highlight {
  background: linear-gradient(135deg, #fef3c7 0%, #fde68a 100%);
}

.info-label {
  font-size: 0.85rem;
  color: #64748b;
  font-weight: 500;
}

.info-value {
  font-weight: 700;
  color: #1e293b;
}

.info-value.mention {
  display: flex;
  align-items: center;
  gap: 0.5rem;
}

.felicitations-badge {
  background: linear-gradient(135deg, #fbbf24, #f59e0b);
  color: white;
  padding: 0.25rem 0.5rem;
  border-radius: 6px;
  font-size: 0.7rem;
  font-weight: 600;
}

/* JURY LIST */
.jury-list {
  display: flex;
  flex-direction: column;
  gap: 1rem;
}

.jury-member {
  display: grid;
  grid-template-columns: 48px 1fr auto;
  gap: 1rem;
  align-items: center;
  padding: 1rem;
  background: #f8fafc;
  border-radius: 12px;
  border-left: 4px solid #e2e8f0;
}

.jury-member.role-president { border-left-color: #f59e0b; }
.jury-member.role-rapporteur { border-left-color: #3b82f6; }
.jury-member.role-examinateur { border-left-color: #10b981; }
.jury-member.role-directeur { border-left-color: #8b5cf6; }
```

```css
.member-avatar {
  width: 48px;
  height: 48px;
  border-radius: 12px;
  background: linear-gradient(135deg, #667eea 0%, #764ba2 100%);
  color: white;
  display: flex;
  align-items: center;
  justify-content: center;
  font-weight: 700;
}

.member-name {
  font-size: 0.95rem;
  font-weight: 700;
  color: #1e293b;
  margin: 0 0 0.25rem 0;
}

.member-etablissement {
  font-size: 0.8rem;
  color: #64748b;
  display: block;
}

.member-email {
  font-size: 0.75rem;
  color: #94a3b8;
}

.member-role {
  text-align: right;
}

.role-badge {
  display: inline-block;
  padding: 0.25rem 0.75rem;
  background: #e2e8f0;
  color: #475569;
  border-radius: 20px;
  font-size: 0.75rem;
  font-weight: 600;
  margin-bottom: 0.25rem;
}

.rapport-status {
  display: block;
  font-size: 0.7rem;
  color: #94a3b8;
}

.rapport-status.received { color: #16a34a; }
.rapport-status.favorable { color: #16a34a; }

.empty-jury {
  text-align: center;
  padding: 2rem;
  color: #64748b;
}

.empty-jury i {
  font-size: 2.5rem;
  margin-bottom: 0.5rem;
}
```

```css
.empty-hint {
  display: block;
  font-size: 0.8rem;
  margin-top: 0.5rem;
  opacity: 0.7;
}

/* TIMELINE */
.timeline {
  position: relative;
  padding-left: 24px;
}

.timeline::before {
  content: '';
  position: absolute;
  left: 7px;
  top: 0;
  bottom: 0;
  width: 2px;
  background: #e2e8f0;
}

.timeline-item {
  position: relative;
  padding: 1rem 0;
  padding-left: 24px;
}

.timeline-marker {
  position: absolute;
  left: -24px;
  top: 50%;
  transform: translateY(-50%);
  width: 16px;
  height: 16px;
  border-radius: 50%;
  background: white;
  border: 2px solid #e2e8f0;
}

.timeline-item.completed .timeline-marker {
  background: #10b981;
  border-color: #10b981;
}

.timeline-item.active .timeline-marker {
  background: #667eea;
  border-color: #667eea;
  box-shadow: 0 0 0 4px rgba(102, 126, 234, 0.2);
}

.timeline-title {
  font-weight: 700;
  color: #1e293b;
  display: block;
}

.timeline-desc {
  font-size: 0.8rem;
  color: #64748b;
}
```

```css
.timeline-item.completed .timeline-title {
  color: #10b981;
}

.timeline-item.active .timeline-title {
  color: #667eea;
}

/* ACTIONS BAR */
.actions-bar {
  display: flex;
  justify-content: space-between;
  align-items: center;
  margin-top: 2rem;
  padding: 1.5rem;
  background: white;
  border-radius: 16px;
  box-shadow: 0 4px 20px rgba(0,0,0,0.05);
  border: 1px solid #e2e8f0;
}

.actions-right {
  display: flex;
  gap: 1rem;
}

.btn-action {
  padding: 0.875rem 1.5rem;
  border: none;
  border-radius: 12px;
  font-weight: 600;
  cursor: pointer;
  display: flex;
  align-items: center;
  transition: all 0.2s;
}

.btn-action:hover {
  transform: translateY(-2px);
}

.btn-action.btn-secondary {
  background: #f1f5f9;
  color: #475569;
}

.btn-action.btn-primary {
  background: linear-gradient(135deg, #3b82f6 0%, #2563eb 100%);
  color: white;
}

.btn-action.btn-success {
  background: linear-gradient(135deg, #10b981 0%, #059669 100%);
  color: white;
}

.btn-action.btn-danger {
  background: linear-gradient(135deg, #ef4444 0%, #dc2626 100%);
  color: white;
}

.btn-action.btn-purple {
  background: linear-gradient(135deg, #8b5cf6 0%, #7c3aed 100%);
  color: white;
```

```
      }

      .btn-action.btn-info {
        background: linear-gradient(135deg, #06b6d4 0%, #0891b2 100%);
        color: white;
      }

      /* RESPONSIVE */
      @media (max-width: 1024px) {
        .content-grid {
          grid-template-columns: 1fr;
        }
      }

      @media (max-width: 768px) {
        .page-header {
          padding: 1.5rem;
        }

        .page-title {
          font-size: 1.5rem;
        }

        .header-meta {
          flex-direction: column;
          gap: 0.5rem;
        }

        .actions-bar {
          flex-direction: column;
          gap: 1rem;
        }

        .actions-right {
          flex-wrap: wrap;
          justify-content: center;
        }

        .jury-member {
          grid-template-columns: 1fr;
          text-align: center;
        }

        .member-avatar {
          margin: 0 auto;
        }

        .member-role {
          text-align: center;
        }
      }
    `]
})
export class SoutenanceDetailComponent implements OnInit {
    Math = Math;
    StatutSoutenance = StatutSoutenance;
    RoleJury = RoleJury;

    soutenance = signal<Soutenance | null>(null);
    isLoading = signal(true);
    error = signal<string | null>(null);

    // Ordre des statuts pour la timeline
    private statutOrder = [
```

```typescript
        StatutSoutenance.BROUILLON,
        StatutSoutenance.SOUMIS,
        StatutSoutenance.PREREQUIS_VALIDES,
        StatutSoutenance.JURY_PROPOSE,
        StatutSoutenance.PLANIFIEE,
        StatutSoutenance.AUTORISEE,
        StatutSoutenance.TERMINEE
    ];

    constructor(
        private route: ActivatedRoute,
        private router: Router,
        private soutenanceService: SoutenanceService
    ) {}

    ngOnInit() {
        const id = this.route.snapshot.paramMap.get('id');
        if (id) {
            this.loadSoutenance(+id);
        } else {
            this.error.set('ID de soutenance invalide');
            this.isLoading.set(false);
        }
    }

    loadSoutenance(id: number) {
        this.isLoading.set(true);
        this.soutenanceService.getSoutenanceById(id).subscribe({
            next: (data) => {
                this.soutenance.set(data);
                this.isLoading.set(false);
            },
            error: (err) => {
                console.error('Erreur:', err);
                this.error.set('Impossible de charger les détails de la
soutenance');
                this.isLoading.set(false);
            }
        });
    }

    goBack() {
        this.router.navigate(['/admin/soutenances']);
    }

    // ===========================================
    // COMPUTED HELPERS
    // ===========================================

    prerequisValides(): boolean {
        const prereq = this.soutenance()?.prerequis;
        if (!prereq) return false;
        return prereq.valide || (
            prereq.nombreArticlesQ1Q2 >= 2 &&
            prereq.nombreConferences >= 2 &&
            prereq.heuresFormation >= 200
        );
    }

    isStepCompleted(step: string): boolean {
        const currentStatut = this.soutenance()?.statut;
        if (!currentStatut) return false;

        const currentIndex = this.statutOrder.indexOf(currentStatut);
```

```typescript
        const stepIndex = this.statutOrder.indexOf(step as StatutSoutenance);

        return stepIndex < currentIndex;
    }

    // ==========================================
    // DISPLAY HELPERS
    // ==========================================

    getHeaderClass(): string {
        const statut = this.soutenance()?.statut;
        switch (statut) {
            case StatutSoutenance.SOUMIS: return 'header-soumis';
            case StatutSoutenance.PREREQUIS_VALIDES:
            case StatutSoutenance.JURY_PROPOSE: return 'header-valide';
            case StatutSoutenance.PLANIFIEE:
            case StatutSoutenance.AUTORISEE: return 'header-planifiee';
            case StatutSoutenance.TERMINEE: return 'header-terminee';
            case StatutSoutenance.REJETEE: return 'header-rejetee';
            default: return 'header-default';
        }
    }

    getStatusBadgeClass(): string {
        return 'status-badge-' + (this.soutenance()?.statut?.toLowerCase() ||
'default');
    }

    getStatusIcon(): string {
        const statut = this.soutenance()?.statut;
        switch (statut) {
            case StatutSoutenance.BROUILLON: return 'bi-pencil';
            case StatutSoutenance.SOUMIS: return 'bi-clock-history';
            case StatutSoutenance.PREREQUIS_VALIDES: return 'bi-check-circle';
            case StatutSoutenance.JURY_PROPOSE: return 'bi-people';
            case StatutSoutenance.PLANIFIEE: return 'bi-calendar-check';
            case StatutSoutenance.AUTORISEE: return 'bi-check-circle-fill';
            case StatutSoutenance.TERMINEE: return 'bi-mortarboard';
            case StatutSoutenance.REJETEE: return 'bi-x-circle';
            default: return 'bi-file-earmark';
        }
    }

    formatStatut(statut: StatutSoutenance): string {
        const labels: Record<string, string> = {
            'BROUILLON': 'Brouillon',
            'SOUMIS': 'En attente',
            'PREREQUIS_VALIDES': 'Prérequis validés',
            'JURY_PROPOSE': 'Jury proposé',
            'PLANIFIEE': 'Planifiée',
            'AUTORISEE': 'Autorisée',
            'TERMINEE': 'Terminée',
            'REJETEE': 'Rejetée'
        };
        return labels[statut] || statut;
    }

    formatRoleJury(role: RoleJury): string {
        const labels: Record<string, string> = {
            'PRESIDENT': 'Président',
            'RAPPORTEUR': 'Rapporteur',
            'EXAMINATEUR': 'Examinateur',
            'DIRECTEUR': 'Directeur',
            'CO_DIRECTEUR': 'Co-directeur'
```

```
    };
    return labels[role] || role;
}

getJuryRoleClass(role: RoleJury): string {
    return 'role-' + role.toLowerCase();
}

getMentionClass(): string {
    const mention = this.soutenance()?.mention?.toLowerCase();
    if (mention?.includes('honorable')) return 'mention-honorable';
    if (mention?.includes('passable')) return 'mention-passable';
    return '';
}

getInitials(name: string | undefined): string {
    if (!name) return '?';
    const parts = name.trim().split(' ');
    if (parts.length >= 2) {
        return (parts[0].charAt(0) + parts[1].charAt(0)).toUpperCase();
    }
    return name.charAt(0).toUpperCase();
}

getAvatarColor(id: number): string {
    const colors = [
        'linear-gradient(135deg, #667eea 0%, #764ba2 100%)',
        'linear-gradient(135deg, #f093fb 0%, #f5576c 100%)',
        'linear-gradient(135deg, #4facfe 0%, #00f2fe 100%)',
        'linear-gradient(135deg, #43e97b 0%, #38f9d7 100%)',
        'linear-gradient(135deg, #fa709a 0%, #fee140 100%)',
        'linear-gradient(135deg, #a18cd1 0%, #fbc2eb 100%)'
    ];
    return colors[(id || 0) % colors.length];
}

// ===========================================
// ACTIONS
// ===========================================

validerPrerequis() {
    if (confirm('Valider les prérequis de cette soutenance ?')) {
        alert('Prérequis validés ! (À implémenter avec le service)');
    }
}

rejeter() {
    const motif = prompt('Motif du rejet :');
    if (motif) {
        alert('Soutenance rejetée ! (À implémenter avec le service)');
    }
}

planifier() {
    alert('Ouvrir le modal de planification (À implémenter)');
}

autoriser() {
    if (confirm('Autoriser cette soutenance à avoir lieu ?')) {
        alert('Soutenance autorisée ! (À implémenter avec le service)');
    }
}

marquerTerminee() {
```

```
        alert('Ouvrir le modal pour saisir la mention (À implémenter)');
    }

    genererPV() {
        alert('Génération du PV de soutenance... (À implémenter avec le service
document)');
    }

    genererAttestation() {
        alert('Génération de l\'attestation... (À implémenter avec le service
document)');
    }
}
```