Analytics Service Integration Guide

Overview

This guide explains how to integrate the Analytics Service with other Mission Engadi microservices and external applications.

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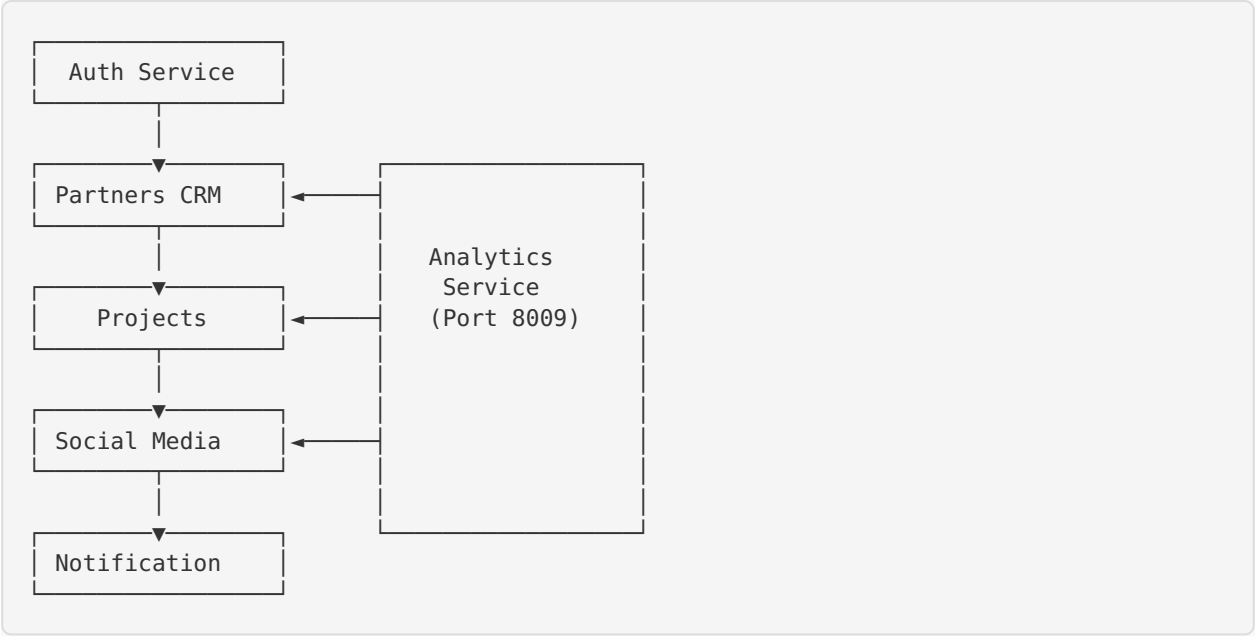
Service Architecture

The Analytics Service integrates with 6 microservices:



Ports:
- Auth Service: 8002
- Partners CRM: 8003
- Projects: 8004
- Social Media: 8007
- Notification: 8008
- Analytics: 8009

Integration Methods

1. Push Integration (Recommended)

Concept: Services send metrics to Analytics Service in real-time.

Advantages:
- Real-time data
- Lower load on source services
- Immediate insights

Implementation:

```
import httpx

async def send_metric(service_name: str, metric_type: str, metric_name: str, value: fl
oat):
    """Send metric to Analytics Service."""
    async with httpx.AsyncClient() as client:
        await client.post(
            "http://analytics-service:8009/api/v1/metrics",
            json={
                "service_name": service_name,
                "metric_type": metric_type,
                "metric_name": metric_name,
                "value": value,
                "timestamp": datetime.utcnow().isoformat()
            },
            headers={"Authorization": f"Bearer {get_service_token()}"}
        )

# Usage
await send_metric("partners_crm", "donation", "new_donation", 100.00)
```

2. Pull Integration

Concept: Analytics Service pulls data from source services.

Advantages:
- No changes to source services
- Centralized sync logic
- Can handle historical data

Implementation:

Analytics Service automatically pulls data via scheduled sync operations.

3. Event-Based Integration (Future)

Concept: Services publish events to message queue (Kafka/RabbitMQ).

Advantages:
- Decoupled architecture
- Scalable
- Event replay capability

Service-to-Service Integration

Partners CRM Integration

Metrics to Track:
- New partner registrations
- Donations received
- Partner engagement
- Communication history

Example Integration:

```python
from app.services.analytics_client import AnalyticsClient

class PartnerService:
    def __init__(self):
        self.analytics = AnalyticsClient()

    async def create_partner(self, partner_data: dict):
        # Create partner logic
        partner = await self.db.create(partner_data)

        # Send metric to analytics
        await self.analytics.send_metric(
            service_name="partners_crm",
            metric_type="partner",
            metric_name="new_partner",
            value=1.0,
            dimensions={
                "partner_type": partner.type,
                "country": partner.country
            }
        )

        return partner

    async def record_donation(self, donation_data: dict):
        # Record donation logic
        donation = await self.db.create(donation_data)

        # Send donation metric
        await self.analytics.send_metric(
            service_name="partners_crm",
            metric_type="donation",
            metric_name="donation_received",
            value=donation.amount,
            dimensions={
                "partner_id": donation.partner_id,
                "currency": donation.currency
            },
            meta={
                "transaction_id": donation.transaction_id
            }
        )

        return donation
```

Projects Integration

Metrics to Track:
- Project creation/completion
- Beneficiaries reached
- Project milestones
- Impact metrics

Example:

```python
class ProjectService:
    async def complete_project(self, project_id: str):
        project = await self.db.get(project_id)
        project.status = "completed"
        await self.db.update(project)

        # Send completion metric
        await self.analytics.send_metric(
            service_name="projects",
            metric_type="project",
            metric_name="project_completed",
            value=1.0,
            dimensions={
                "project_type": project.type,
                "duration_days": (project.end_date - project.start_date).days
            }
        )

        # Send beneficiary metric
        await self.analytics.send_metric(
            service_name="projects",
            metric_type="beneficiary",
            metric_name="beneficiaries_reached",
            value=project.beneficiaries_count
        )
```

Social Media Integration

Metrics to Track:
- Posts created
- Engagement (likes, comments, shares)
- Reach and impressions
- Platform-specific metrics

Example:

```python
class SocialMediaService:
    async def create_post(self, post_data: dict):
        post = await self.db.create(post_data)

        await self.analytics.send_metric(
            service_name="social_media",
            metric_type="social_post",
            metric_name="post_created",
            value=1.0,
            dimensions={
                "platform": post.platform,
                "content_type": post.content_type
            }
        )

        return post

    async def update_engagement(self, post_id: str, engagement_data: dict):
        # Update engagement logic
        await self.db.update_engagement(post_id, engagement_data)

        # Send engagement metrics
        for metric, value in engagement_data.items():
            await self.analytics.send_metric(
                service_name="social_media",
                metric_type="engagement",
                metric_name=f"post_{metric}",
                value=value,
                dimensions={"post_id": post_id}
            )
```

Notification Integration

Metrics to Track:

- Notifications sent
- Delivery status
- Channel performance
- User engagement

Example:

```python
class NotificationService:
    async def send_notification(self, notification_data: dict):
        # Send notification logic
        result = await self.send(notification_data)

        # Track notification sent
        await self.analytics.send_metric(
            service_name="notification",
            metric_type="notification",
            metric_name="notification_sent",
            value=1.0,
            dimensions={
                "channel": notification_data["channel"],
                "template_id": notification_data.get("template_id")
            }
        )

        # Track delivery status
        if result.delivered:
            await self.analytics.send_metric(
                service_name="notification",
                metric_type="notification",
                metric_name="notification_delivered",
                value=1.0,
                dimensions={"channel": notification_data["channel"]}
            )
```

Client Integration

JavaScript/TypeScript Client

Installation:

```
npm install axios
```

Client Implementation:

```typescript
import axios, { AxiosInstance } from 'axios';

class AnalyticsClient {
  private client: AxiosInstance;

  constructor(baseURL: string, token: string) {
    this.client = axios.create({
      baseURL,
      headers: {
        'Authorization': `Bearer ${token}`,
        'Content-Type': 'application/json'
      }
    });
  }

  async createMetric(data: MetricData) {
    const response = await this.client.post('/api/v1/metrics', data);
    return response.data;
  }

  async getPartnerStatistics(startDate?: string, endDate?: string) {
    const response = await this.client.get('/api/v1/analytics/partners/statistics', {
      params: { start_date: startDate, end_date: endDate }
    });
    return response.data;
  }

  async getDashboard(dashboardId: string) {
    const response = await this.client.get(`/api/v1/dashboards/${dashboardId}`);
    return response.data;
  }

  async getDashboardData(dashboardId: string) {
    const response = await this.client.get(`/api/v1/dashboards/${dashboardId}/data`);
    return response.data;
  }
}

// Usage
const analytics = new AnalyticsClient(
  'http://localhost:8009',
  'your-jwt-token'
);

const stats = await analytics.getPartnerStatistics('2024-01-01', '2024-12-31');
```

Python Client

Installation:

```
pip install httpx
```

Client Implementation:

```python
import httpx
from typing import Optional, Dict, Any
from datetime import date

class AnalyticsClient:
    def __init__(self, base_url: str, token: str):
        self.base_url = base_url
        self.headers = {
            "Authorization": f"Bearer {token}",
            "Content-Type": "application/json"
        }

    async def create_metric(self, data: Dict[str, Any]):
        async with httpx.AsyncClient() as client:
            response = await client.post(
                f"{self.base_url}/api/v1/metrics",
                json=data,
                headers=self.headers
            )
            return response.json()

    async def get_partner_statistics(
        self,
        start_date: Optional[date] = None,
        end_date: Optional[date] = None
    ):
        params = {}
        if start_date:
            params["start_date"] = start_date.isoformat()
        if end_date:
            params["end_date"] = end_date.isoformat()

        async with httpx.AsyncClient() as client:
            response = await client.get(
                f"{self.base_url}/api/v1/analytics/partners/statistics",
                params=params,
                headers=self.headers
            )
            return response.json()

# Usage
analytics = AnalyticsClient("http://localhost:8009", "your-jwt-token")
stats = await analytics.get_partner_statistics()
```

Data Sync

Automatic Sync

Analytics Service can automatically sync data from source services:

Configuration (.env):

```
SYNC_ENABLED=true
SYNC_INTERVAL_MINUTES=60
PARTNERS_CRM_URL=http://partners-crm:8003
PROJECTS_URL=http://projects:8004
SOCIAL_MEDIA_URL=http://social-media:8007
NOTIFICATION_URL=http://notification:8008
```

Manual Sync

Trigger sync via API:

```
curl -X POST http://localhost:8009/api/v1/sync \
  -H "Authorization: Bearer $TOKEN" \
  -H "Content-Type: application/json" \
  -d '{
    "service_name": "partners_crm",
    "sync_type": "incremental"
  }'
```

Trigger full aggregation:

```
curl -X POST http://localhost:8009/api/v1/sync/aggregate-all \
  -H "Authorization: Bearer $TOKEN"
```

Best Practices

1. Metric Naming

Use consistent naming conventions:

- Use snake_case: `new_partner`, `donation_received`
- Be descriptive: `email_sent` not `sent`
- Include action: `partner_created`, `project_completed`

2. Dimensions

Use dimensions for categorical data:

```
dimensions={
    "partner_type": "individual",
    "country": "USA",
    "campaign": "winter-2024"
}
```

3. Metadata

Use metadata for additional context:

```
meta={
    "transaction_id": "txn_123",
    "user_agent": "mobile-app",
    "source": "web"
}
```

4. Error Handling

Always handle analytics errors gracefully:

```python
try:
    await analytics.send_metric(...)
except Exception as e:
    logger.error(f"Analytics error: {e}")
    # Don't fail the main operation
```

5. Batching

Batch metrics when possible:

```python
metrics = [
    {"metric_name": "metric1", "value": 1.0},
    {"metric_name": "metric2", "value": 2.0}
]
await analytics.bulk_create_metrics(metrics)
```

6. Async Operations

Use async for non-blocking analytics:

```python
# Fire and forget
asyncio.create_task(analytics.send_metric(...))

# Or use background tasks in FastAPI
background_tasks.add_task(analytics.send_metric, ...)
```

Troubleshooting

Connection Issues

Problem: Cannot connect to Analytics Service

Solution:
1. Check service is running: `curl http://localhost:8009/api/v1/health`
2. Verify network connectivity
3. Check firewall rules
4. Verify service URL in configuration

Authentication Issues

Problem: 401 Unauthorized errors

Solution:
1. Verify JWT token is valid
2. Check token expiration
3. Ensure correct Authorization header format
4. Verify service has required permissions

Sync Issues

Problem: Data not syncing from source services

Solution:
1. Check sync status: `GET /api/v1/sync/status`
2. Review sync logs
3. Verify source service URLs
4. Check authentication between services
5. Trigger manual sync to test

Performance Issues

Problem: Slow analytics responses

Solution:
1. Check database indexes
2. Review query performance
3. Consider data retention policies
4. Implement caching
5. Scale horizontally if needed

Support

For integration support:
- **Documentation**: See API_DOCUMENTATION.md
- **Issues**: GitHub Issues
- **Email**: support@engadi.org