

Final Optimized MongoDB Database Structure

User

```
{
  _id: ObjectId("userId"),
  name: "Ashok Seran",
  email: "ashok@example.com",
  fingerprintIds: [ObjectId("fingerprintId1"), ObjectId("fingerprintId2")],
  ipAddressIds: [ObjectId("ipId1"), ObjectId("ipId2")],
  startedAt: ISODate("2025-11-06T09:00:00Z"),
  lastVisit: ISODate("2025-11-06T13:20:00Z"),
  stats: { totalDevices: 2, totalIPs: 5, totalEvents: 240 },
  isActive: true
}
```

Device_Details

```
{
  _id: ObjectId("fingerprintId1"),
  userId: ObjectId("userId"),
  fingerprintHash: "b132hj56lxy...",
  deviceInfo: { os: "Windows 11", browser: "Chrome 141.0", deviceType: "Desktop" },
  latestIP: { ipAddress: "192.168.1.50", country: "India", city: "Chennai" },
  ipHistory: [{ ipAddress: "192.168.1.40" }, { ipAddress: "192.168.1.50" }],
  firstSeen: ISODate("2025-11-05T09:00:00Z"),
  lastSeen: ISODate("2025-11-06T13:18:00Z")
}
```

IP_Address

```
{
  _id: ObjectId("ipId1"),
  userId: ObjectId("userId"),
  fingerprintId: ObjectId("fingerprintId1"),
  ipAddress: "192.168.1.50",
  location: { country: "India", state: "Tamil Nadu", city: "Chennai" },
  isp: "Jio Fiber",
  firstSeen: ISODate("2025-11-06T09:10:00Z"),
  lastSeen: ISODate("2025-11-06T13:18:00Z")
}
```

```
}
```

Event

```
{  
  _id: ObjectId("eventId1"),  
  userId: ObjectId("userId"),  
  fingerprintId: ObjectId("fingerprintId1"),  
  eventType: "click",  
  eventObject: { page: "/dashboard", action: "save_button", metadata: { value: "Order  
Confirmed" } },  
  createdAt: ISODate("2025-11-06T13:18:12Z")  
}
```

Relationships

User -> Device_Details (many)

Device_Details -> IP_Address (many)

Device_Details -> Event (many)