Introduction to Magma

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The problem of bringing the next billion onto a faster internet is a problem of heterogeneity.

Heterogeneity in access, backhaul, scale and business models.
Design Principles
Why Magma? Why Facebook?

1. Encapsulation of state and the fabric
2. State in control planes
3. Software release and fault domains
Magma Architecture

Orchestrator

Public/Private Cloud

Federation Gateway

MNO legacy Core

Access Gateway

Packet Core

SGW  PGW

MME  AAA

Internet

Access

Edge
The diagram illustrates the architecture of a communication network, focusing on the Policy and Charging Rules Function (PCRF), session management, and mobility handling. The network elements include:

- **PCRF**: Controls policy and charging decisions for delivered services.
- **PCC Rules**: Session context rules for policy and charging control.
- **Session CRUD**: CRUD operations for session management.
- **policydb**: Database for policy rules.
- **sessiond**: Session management daemon.
- **mobilityd**: Mobility management daemon.
- **pipeline**: Packet processing pipeline.
- **MME**: Mobile Management Entity.
- **SCTPd**: Session Control Traffic Processing daemon.
- **PDN-1**: e.g., Internet.
- **PDN-2**: e.g., IMS.
- **PDN-3**: e.g., edge cloud.
- **UE** (User Equipment): Mobile device endpoint.
- **eNB**: Evolved Node B, network access point.
- **OVS**: Open vSwitch, network switch.
- **Port-S1**: Signaling port for S1 interface.
- **Port-SGi**: Signaling port for SGi interface.

The diagram outlines the flow of messages and data between these components, emphasizing the integration of policy, charging, session, and mobility management systems.
Encapsulation and the Fabric
Each middlebox has state and policy associated with workloads

- State needs to be in sync across services (config + runtime)
- Policy needs to be enforced at high packet rates
- Independently solved scaleout + high availability
- Hard to adapt to dynamic workloads (tasks/VMs lifecycle/moving)
Modularize the network: Fabric responsible for moving packets faster. Distributed edge responsible for rich policy enforcement and state.
Today’s GSM/LTE architecture

SGW/PGW are chokepoint devices
Encapsulation in traditional LTE networks

UE state exists in all nodes
- No clear device abstractions
- Air interface specifics leak through the network
Magma takeaway: Encapsulation and the fabric

Why Magma? Why Facebook?

- Encapsulate the UE state
  - Config maintained in a central location
  - Runtime encapsulated at the edge
- Distribute policy enforcement point
  - Let the ideal topology decide the policy enforcement point
- Keep core network simple
  - Allows for easy scale up/down
  - Cheap: Core network only needs to move packets fast
- Abstract away radio specific technology
- Focus on operationalizing the network

Mobility is complicated but solved in the datacenter (IP is both identity and location)
State in the control plane
Magma takeaway 2: State in control plane

- Desired state model: Centralized through APIs
  - User inputs intent, control plane enforces it
- Control logic completely decoupled from datapath
  - Programmable APIs exposed by datapath
  - Independent evolution of control + datapath
- Use modern distributed systems to propagate state
  - HTTP2, Protobuf, K/V store
Software release

The need for fault domains
SGW/PGW are chokepoint devices

Software delivery: Too big to fail

VOICE/SMS NETWORK

THE INTERNET
Software delivery: Fault domain
Design for localized fault domains

- Small upgrade domains
  - Each node is independently upgradable
  - Gradual rollout is baked into the platform

- Control plane independent from dataplane operations
  - Existing traffic not affected by control plane outage
Summarizing: Solving for heterogeneity

Why Magma? Why Facebook?

- **Flexibility**: Modularize the network into a fast fabric and a policy rich edge
- **Scalability**: Encapsulate UE state and use proven distribution techniques
- **Any spectrum (4G/wifi/5G)**: Localize air interface specifics to the edge
- **Programmability**: Desired state store model with a centralized controller
- **Agility**: Design for upgrades by minimizing fault domains
Ovs collaboration opportunities

Why Magma? Why Facebook?

- **MSS clamping**: Many phones don’t respect MTU settings
- **Routing support**: Add support for route action:
  - Action managed by local agent or controller
  - Also add support for route advertisement.
- **GTP support in kernel**
- **IPFIX extension**: Add support for custom fields
Thank You