Network Planes and Parallel Internets: A Framework for Lightweight QoS Provisioning

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Essence of AGAVE solution

- Separation of Service Provider (SP) and IP Network Provider (INP) concerns
- Specification of SP-INP interactions/agreements
  - abstraction of
    - network capabilities to SP
    - service requirements to INP
  - hide complexity
  - aid manageability
  - technology/implementation independence
- Investigation of service connectivity requirements and the means to achieve them through the virtualisation of network resources
- Introduction of concept of *Parallel Internets* that enable *end-to-end* service differentiation across multiple administrative domains
  - coexisting parallel networks composed of interconnected, per-domain, *Network Planes*
  - differentiation in terms of QoS, availability and resilience

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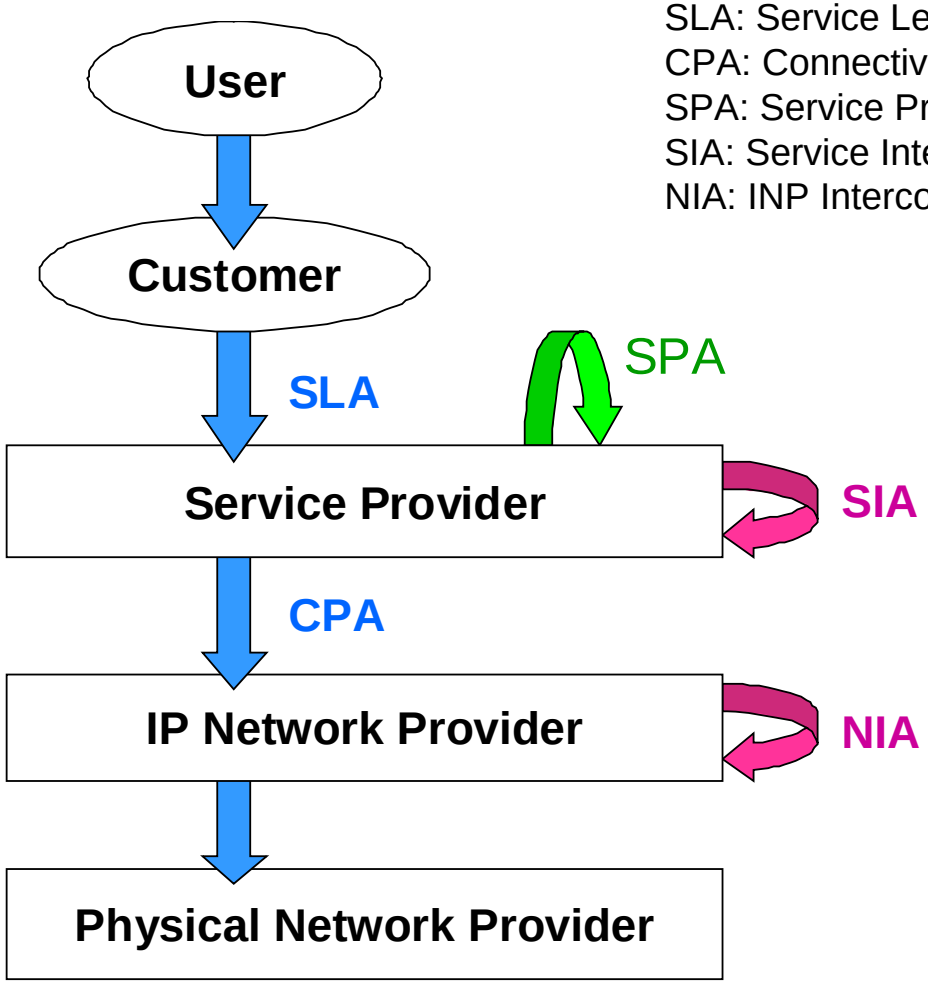
AGAVE high-level business model

SLA: Service Level Agreement
CPA: Connectivity Provisioning Agreement
SPA: Service Provisioning Agreement
SIA: Service Interconnection Agreement
NIA: INP Interconnection Agreement



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Network Planes

- A logical partition of an INP's network resources designed to transport traffic flows from services with common connectivity requirements

  - *Routing aspect*: traffic treatment is differentiated in terms of the routes taken through the INP's network
  - *Forwarding aspect*: use different queuing and scheduling mechanisms, e.g. DiffServ PHBs
  - *Resource Management aspect*: traffic treatment differentiated by the admission control, traffic shaping and policing mechanisms associated with a NP and the resources allocated to it in terms of dedicated or shared network capacity

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Network Planes and Parallel Internets

- Network Planes are *internal* to INPs
  - Designed to accommodate requirements of SPs and customer/peer INPs captured in Connectivity Provisioning Agreements and INP Interconnection Agreements
  - Convey traffic from one or several services managed by the same or different SPs
  - Introducing new services is a matter of increasing the traffic on a Network Plane and not configuring service-specific features in the network

- Parallel Internets are inter-domain extensions of Network Planes
  - from the perspective of a single INP
  - Based on agreements with peer and/or remote INPs: INP Interconnection Agreements (NIA)
  - may be >1 NIA between two INPs, e.g. one for each PI

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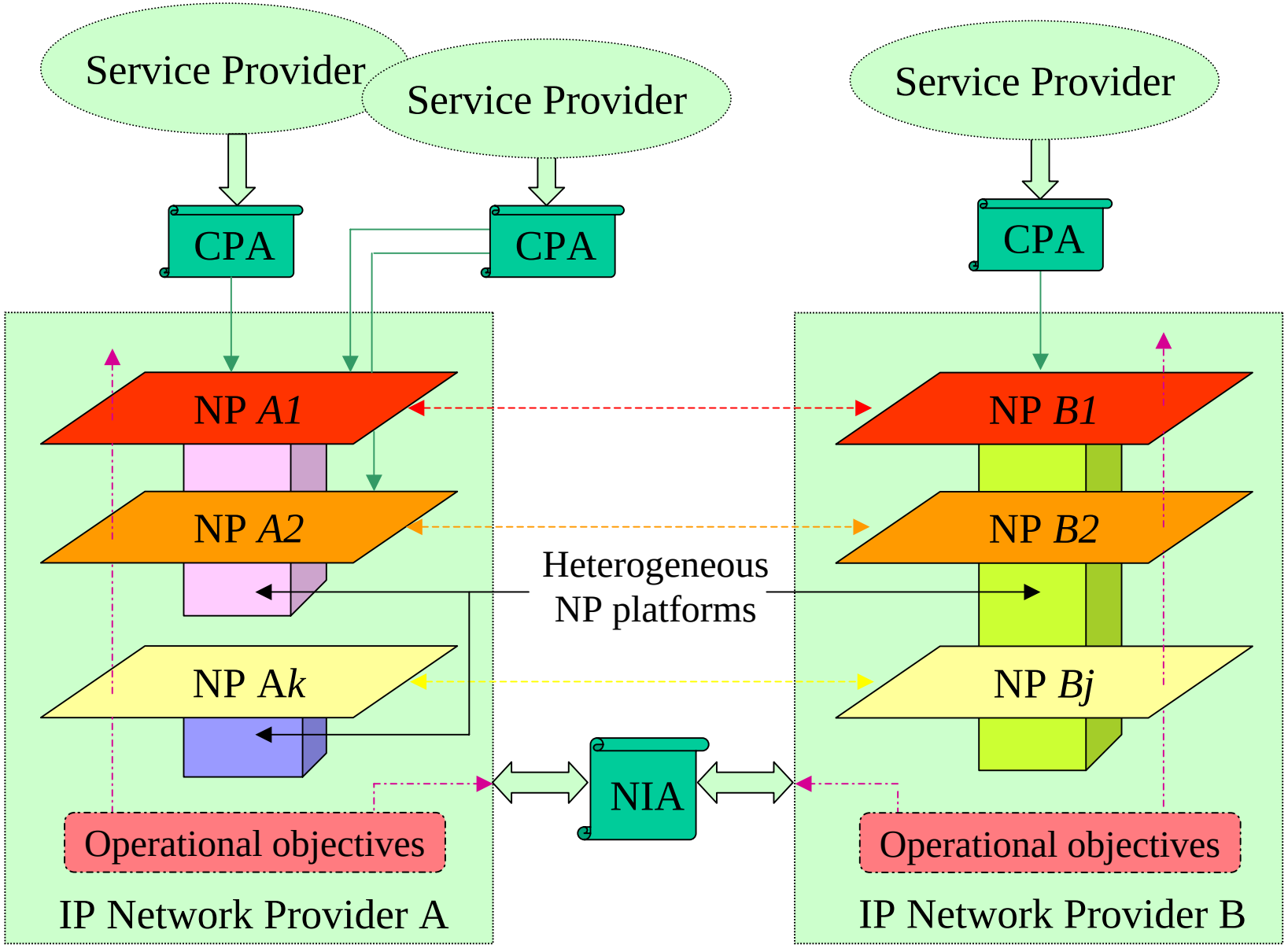
NP/PI Realisation Overview



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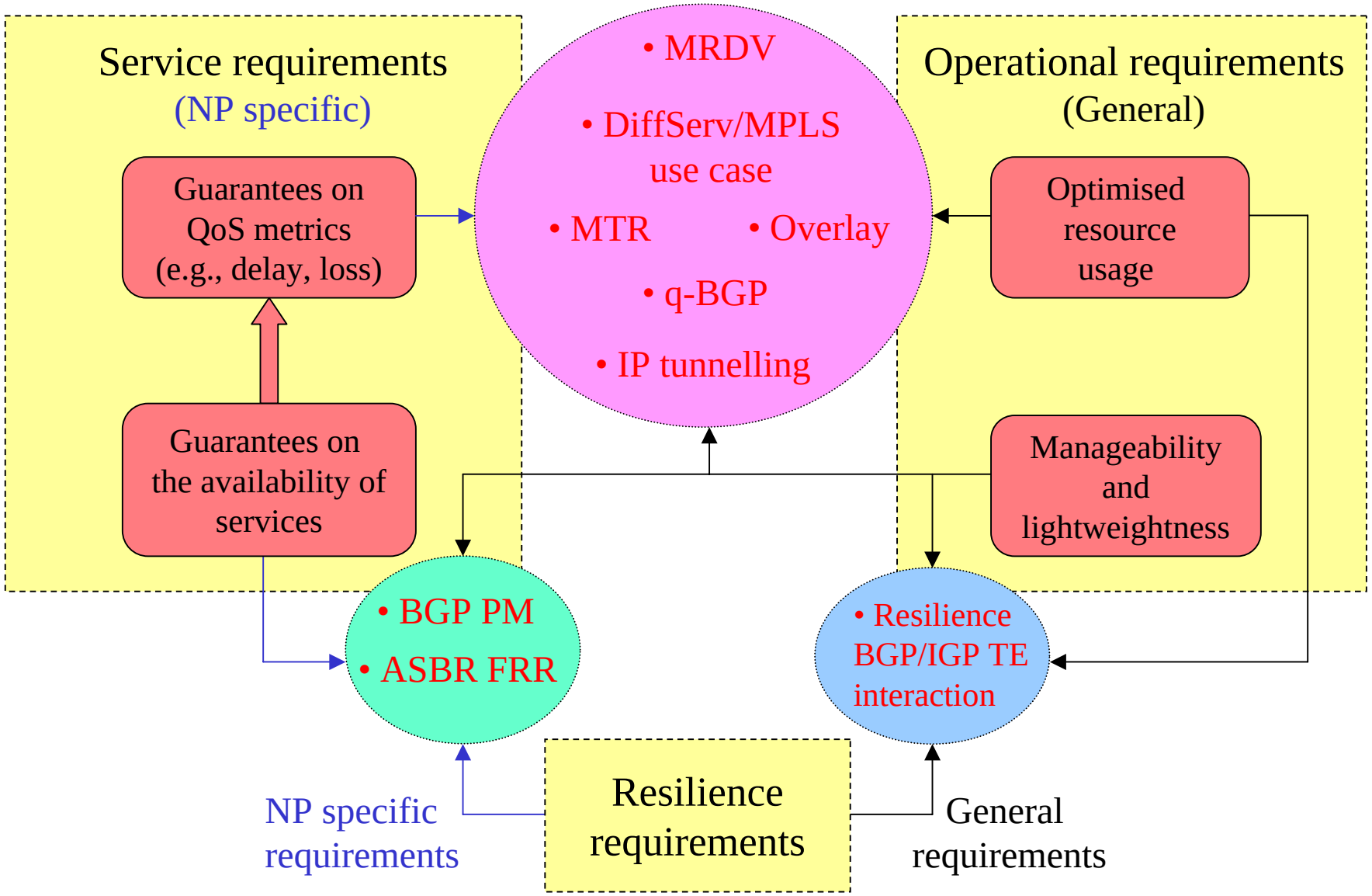
Dealing with NP Requirements



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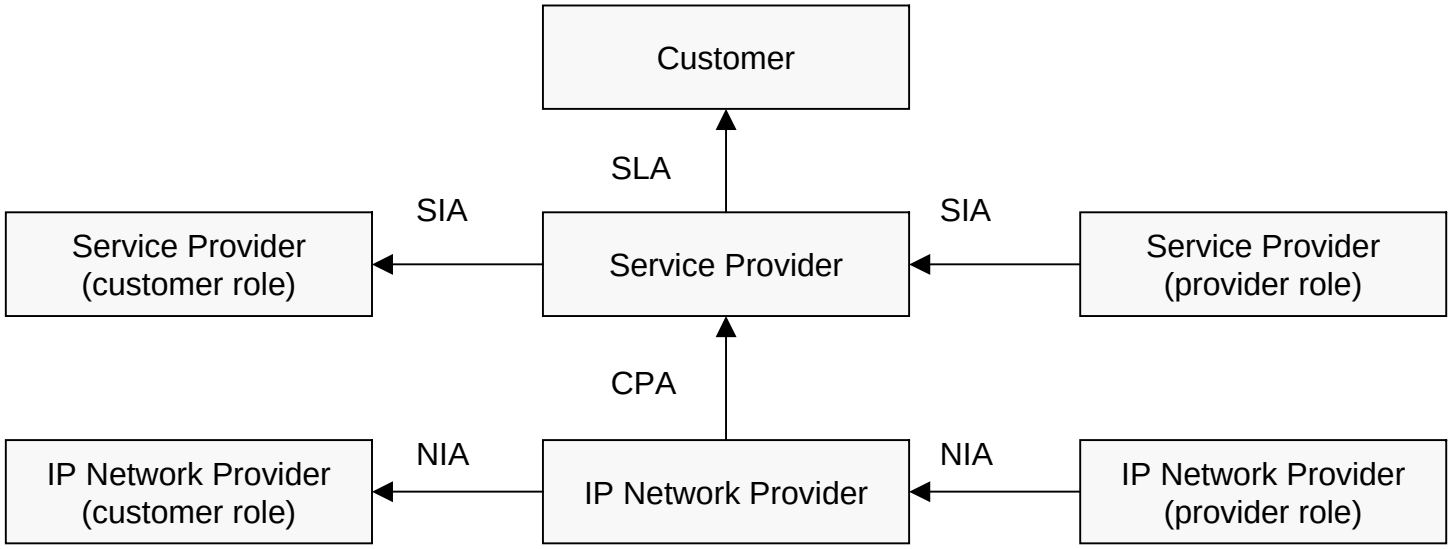
Interactions between business roles



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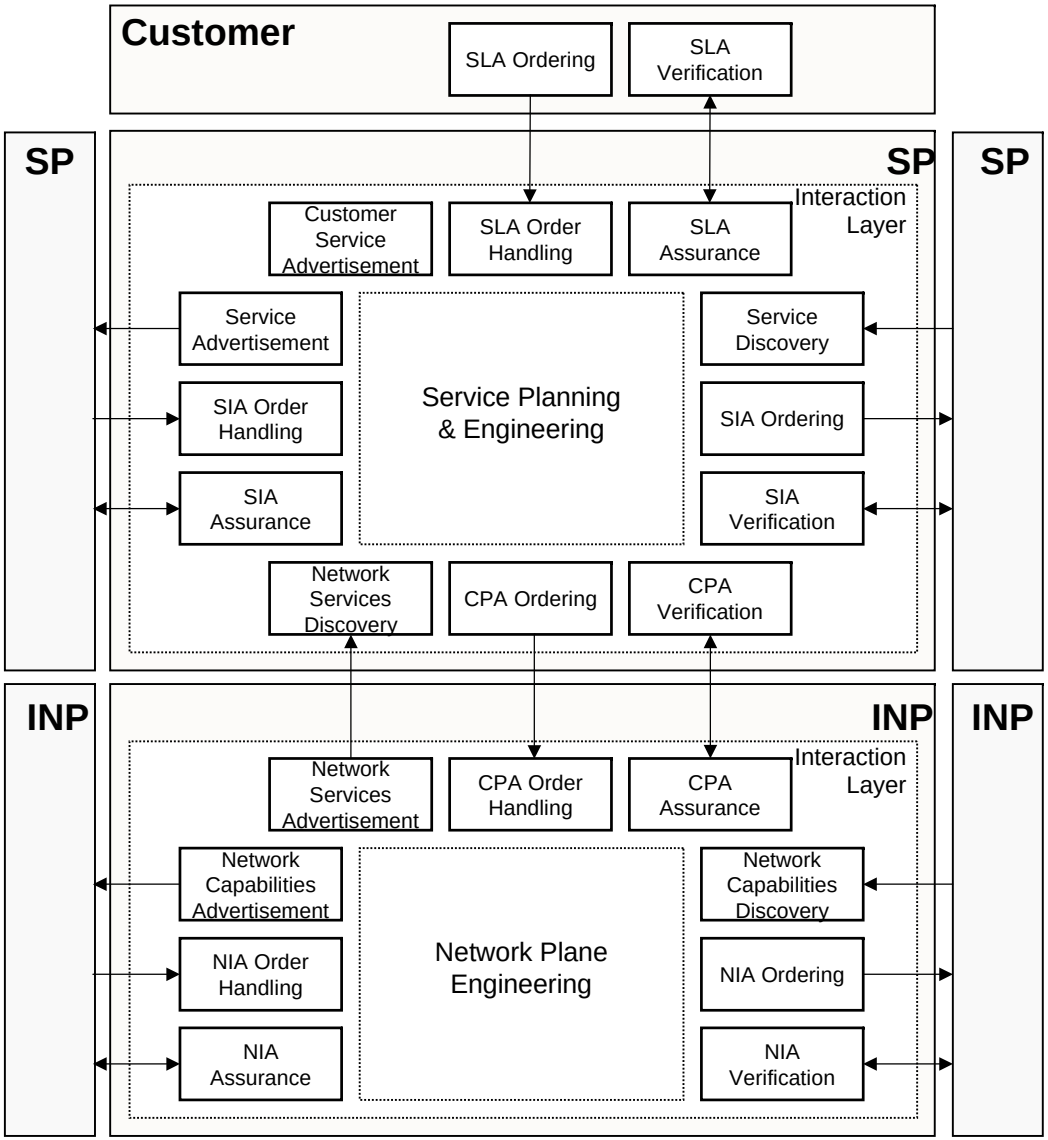
AGAVE Functional Architecture



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Rationale for decomposition of NP Engineering

- Process-oriented approach to mirror internal INP organisational structure
  - Pragmatic view of AGAVE partners
- Identification of internal business roles/functions and their concerns
  - commercial view - focussed on maximising income through selling CPAs
  - network planning - focussed on optimising the network
  - network engineering - focussed on implementation and configuration details
- Need well defined interactions based on issues of common concern

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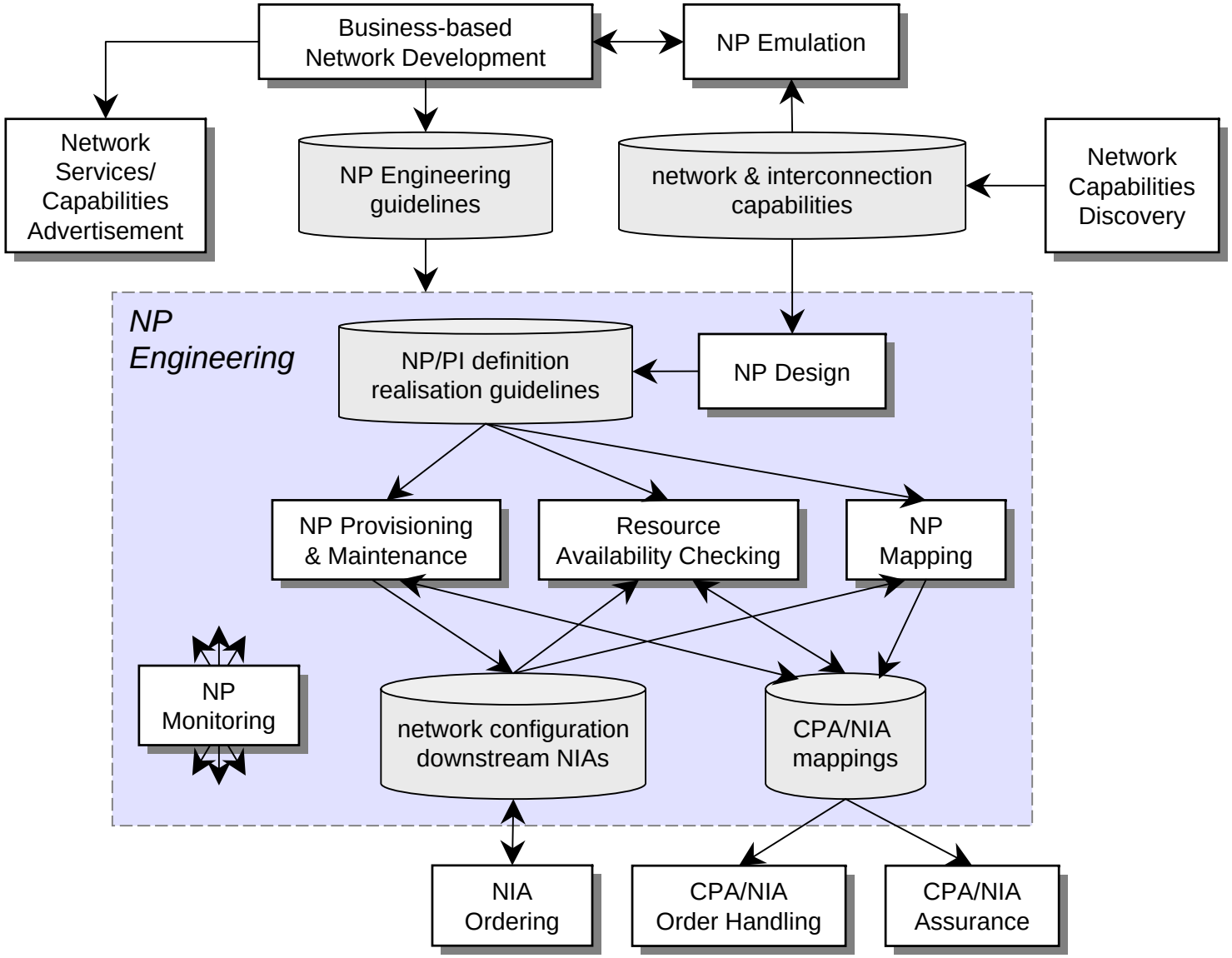
Functional Architecture: NP Engineering



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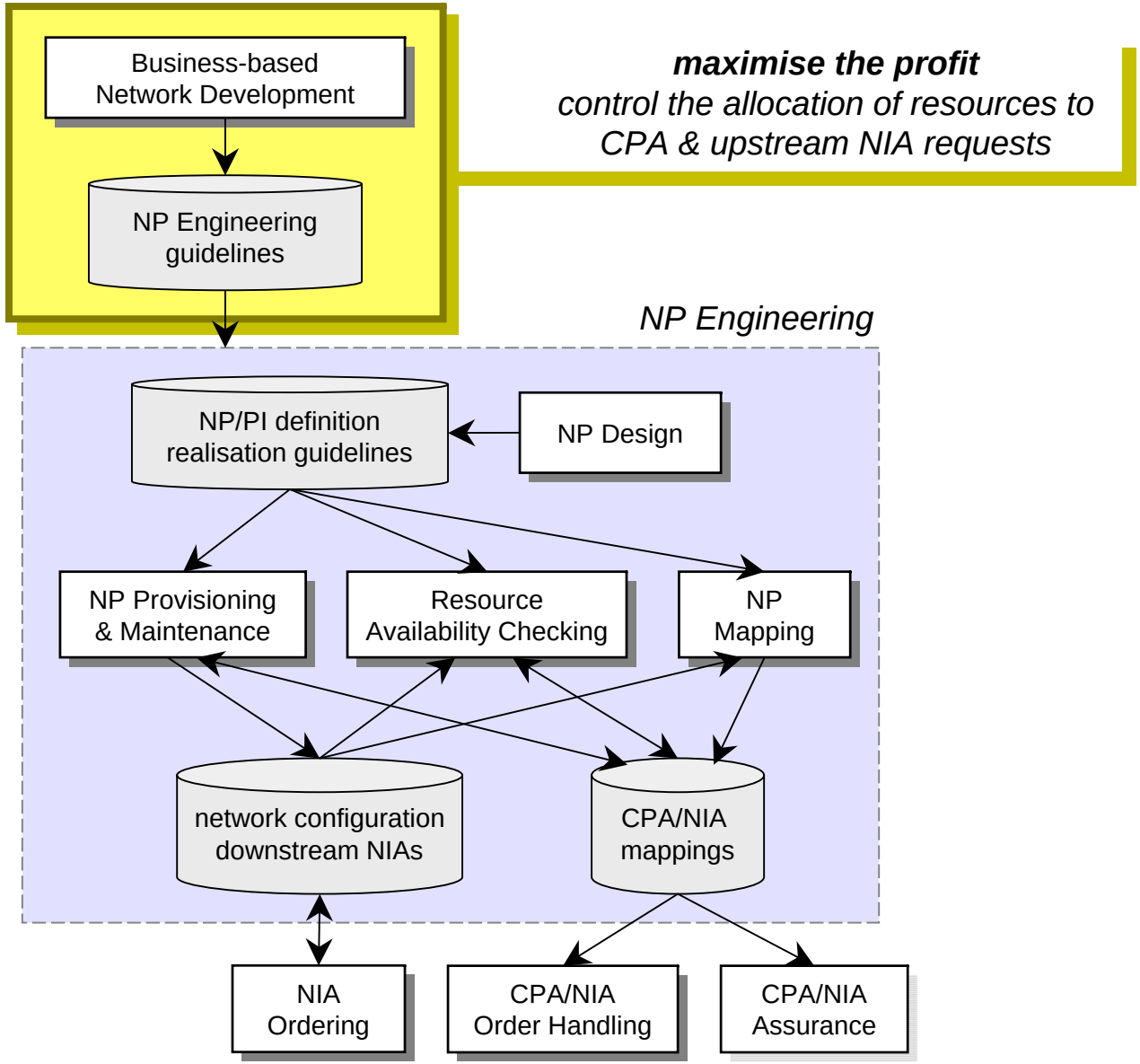
(1) set business guidelines



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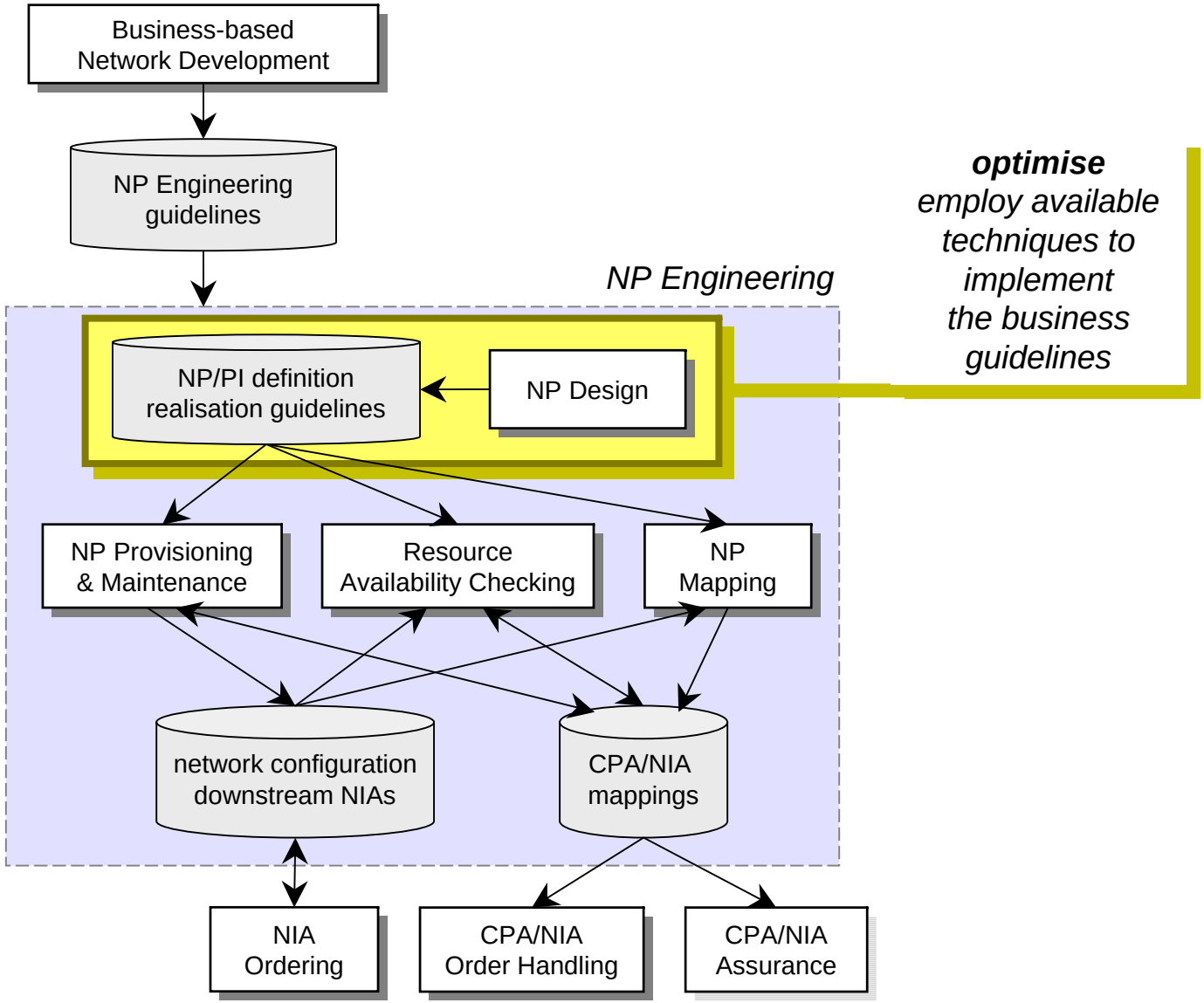
(2) network design



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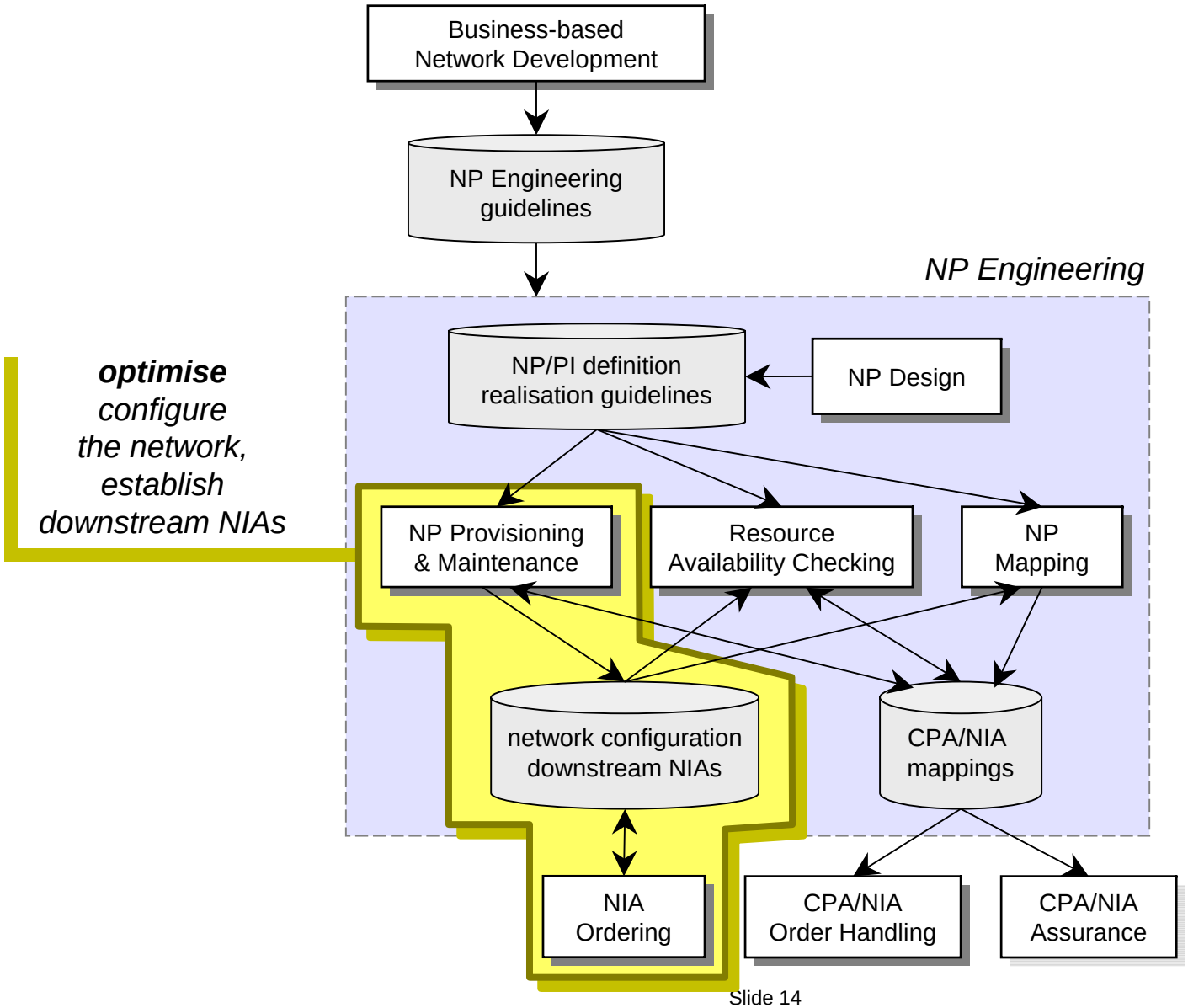
(3) operate



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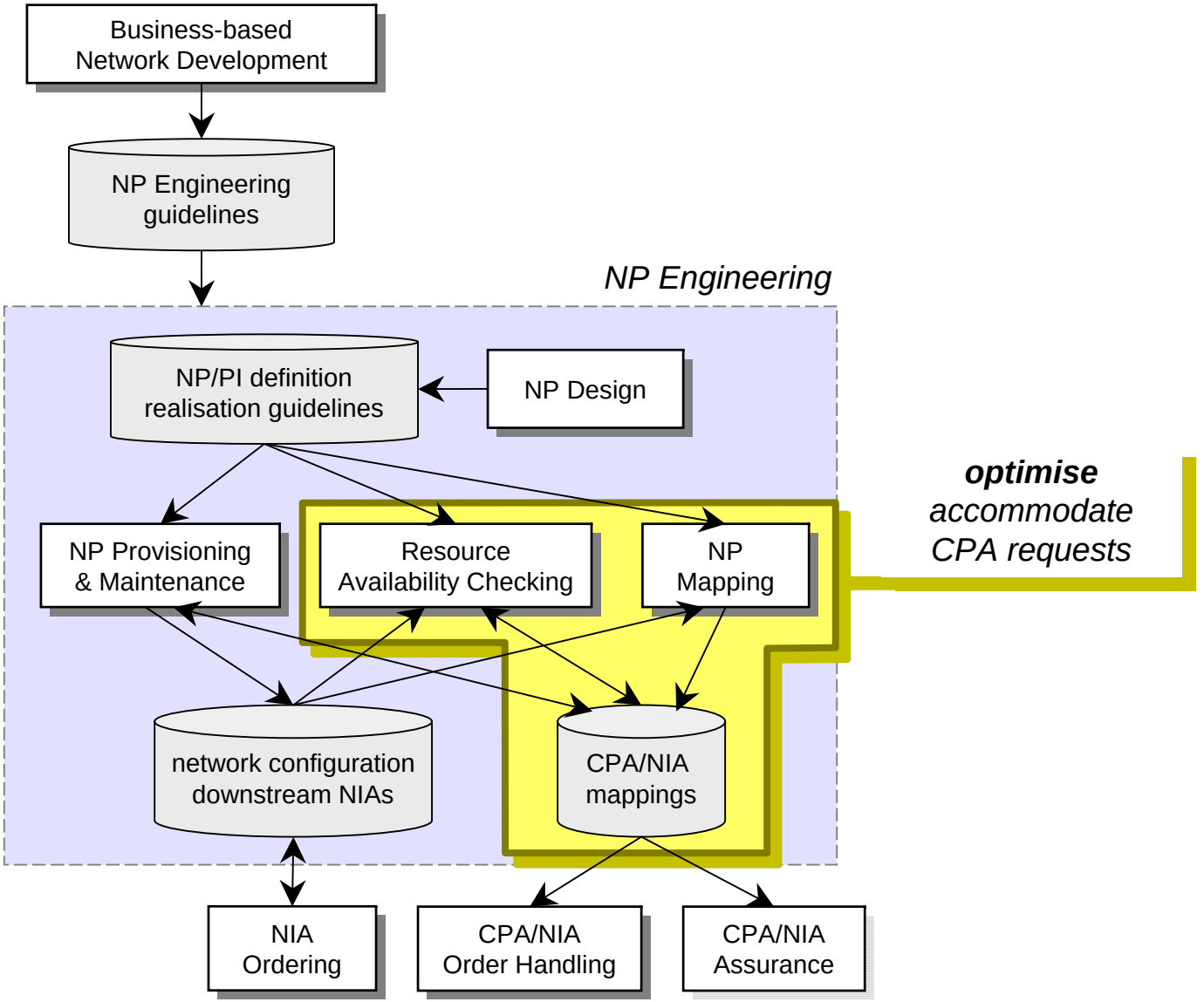

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Summary

- Well-defined separation of service and network concerns
- Network support of service differentiation without being service-aware
- Functional decomposition based on pragmatic business considerations
  - Models for interactions and information exchange
- Investigation of mechanisms to implement Network Planes and Parallel Internets

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