Greek Interoperable Tolling Systems
Lessons Learned by the Implementation and 1st year of Operation of ETC Interoperability in 5 Concessions in Greece.

by

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The issue of interoperability in Greece 1/3
Tolling in Greek roads

- 1st Tolls applied in 1867 (Argolida prefecture), Peloponnese

- Today – 1545.3 km of Tolled Motorways, Bridges and Tunnels in operation (not incl. sections to be constructed)

	Network length (km)	Tag Issuer	ETC Toll Charger
Egnatia Odos	696 (*)	No**	No**
Attiki Odos	65	Yes	Yes
Olympia Odos	205	Yes	Yes
Aegean Motorway	230	Yes	Yes
Moreas	148	No	Yes
Nea Odos	173	Yes	Yes
Kentriki Odos	25	No	Yes
Gefyra	3,3	Yes	Yes
Total	**1545,3**	**5**	**7**

(*) including Malgara-Kleidi & Aktio - Preveza submerged tunnel

(**) Egnatia Odos operates TEO-pass in 2 toll plazas (Malgara & Aktio tunnel) recently transferred under its responsibility after TEO's dissolution

Mainline Toll Plazas 2014

Open Tolling Systems used

- Zone based (Inter-urban Motorways)
- Flat (Urban Motorways, Tunnels, Bridges)

The issue of interoperability in Greece 2/3
Electronic Toll Collection in Greek roads

6 Tag Issuers - all CEN/TC278 A1 Compliant

1. **Attiki Odos- e-Pass 2002**
2. **TEO-Pass 2004**
3. **Gefyra e-Pass 2005**
4. **Aegean Motorway– e-Way 2009**
5. **Olympia Odos – Olympia Pass 2009**
6. **Nea Odos – Fast Pass 2012**

The issue of interoperability in Greece 3/3
First steps towards ETC Interoperability

2008 – Attiki Odos e-Pass tags accepted in Moreas and Olympia Odos motorways through a one-way interim ETC Interoperability scheme

2008 – Greek State National Interoperability Committee formed, with the participation of all Public & Private tag Issuers & Chargers for the implementation of National Interoperability and preparation towards the European Electronic Toll Service (EETS).

2009 - **Gr**eek **I**nteroperable **T**olling **S**ystems (GRITS) Initiative by Attiki Odos, Aegean Motorway, Gefyra, Moreas and Olympia Odos

- 5 Toll Chargers- 4 Tag Issuers
- 651.3 km network in operation today (Urban/Inter-urban Motorways and The Rion-Antirrion Bridge)
- Over 500.000 tags combined customer base

2012 – Launch of GRITS service

Greek Interoperable Tolling Systems Initiative 1/3
Objectives

✓Provide a uniform and "non-stop" service to users with guaranteed level of service

✓Implement a technical and contractual platform open to others targeting to a National interoperability and compatible with relevant EU directives.

✓Implement a robust state of the art solution, based on open interfaces with minimum life cycle cost

✓Comply with the "One contract – One Tag" principle

✓No cost for the customer (no roaming fees)

✓Maintain the equality principle, all GRITS members regardless of the number of customers / volume of interoperable transactions have the same rights and obligations towards each other

✓Common procedures for customer service, operation, technical support and peer to peer clearing & reconciliation

The GRITS Network

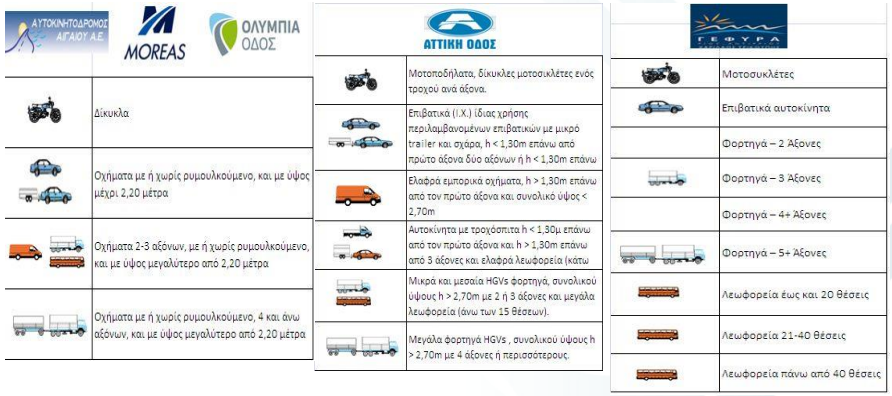
Greek Interoperable Tolling Systems Initiative 2/3 Challenges

✓**Over 99% of accounts are pre-paid and adjacent networks exist:**

- ➢ System needs to support **near real time** tag list and transaction data transfer – database updates

✓**Three different Classification Structures** within GRITS:

- ➢All parties must implement automatic charging through measured class and implement common rules on special cases of classification



✓**Multiple and diverse discount plans** within GRITS:

- ➢Customer must chose tag based on network more frequently used

ATTIKI ODOS EXPRESS Friendly BONUS

AEGEAN MOTORWAY S.A. e-way LOCAL
For specific Toll plazas

GEFYRA 10 YEARS Together we build bridges
E-Pass Car
E-Pass Truck

OLYMPIA ODOS
ΕΛΕΥΣΙΝΑ Value
ΙΣΘΜΟΣ Value
Value PLUS

Greek Interoperable Tolling Systems Initiative 3/3
Supplementary Activities

The following Supplementary Activities were also performed:

✓**Regulatory framework:**

- New contractual framework implemented, through main GRITS Agreement signed by all parties, compliant to EU and National legislation, regulating Commercial, Operational, Accounting and Technical aspects

✓**Implementation of Common Standard Operating Procedures, guaranteeing a uniform Level of Service**

- Customer Service, Maintenance, Plaza Operation
- Communication, Complaints, Claims

✓**Customer Contracts**:

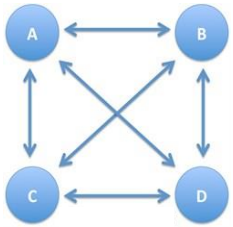
- Customer Service Contract amendments with new common Terms and Conditions for GRITS Service

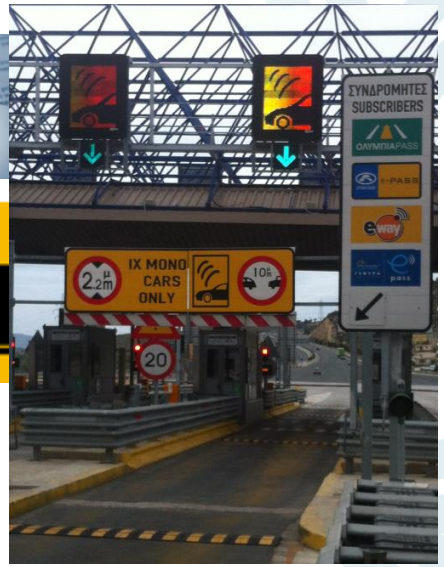
✓**Communication of Service to Users**

- Joint Communications Campaign (letters, leaflets, press, web)
- Launched concurrently in all GRITS Network
- Common signage in Plazas
- Training of over 1000 Operations personnel

✓**Clearing, Reconciliation:**

- Bilateral GRITS Partner Contracts for peer to peer clearing & reconciliation procedures and declaration of GRITS revenues to TAX authorities



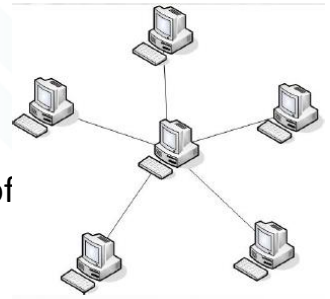


Technical Solution 1/3
Selection of Architecture

Peer to Peer vs Centralized Architecture - both Solutions were examined (Pros/Cons, +/-)

Centralized Architecture :

–**Setting up of a new specific purpose Legal Entity** (Exchange Agent) & **Central Technical Platform**



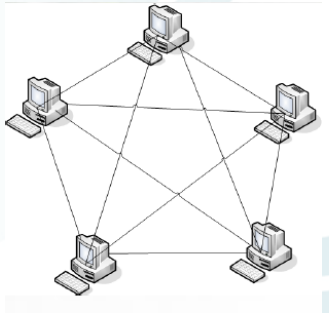
–**Possible changes in legal framework** (especially in case of State or Public Sector Involvement)

–**Additional cost incurring and time consuming activities** (implementation of central facilities, hiring of personnel)

–**Single central point of failure** (central system) in the system.

Peer to Peer architecture :

+**Administratively and Technically Faster and more cost effective to implement** Only requires inter-Party agreements and not a Central Authority / Central Platform



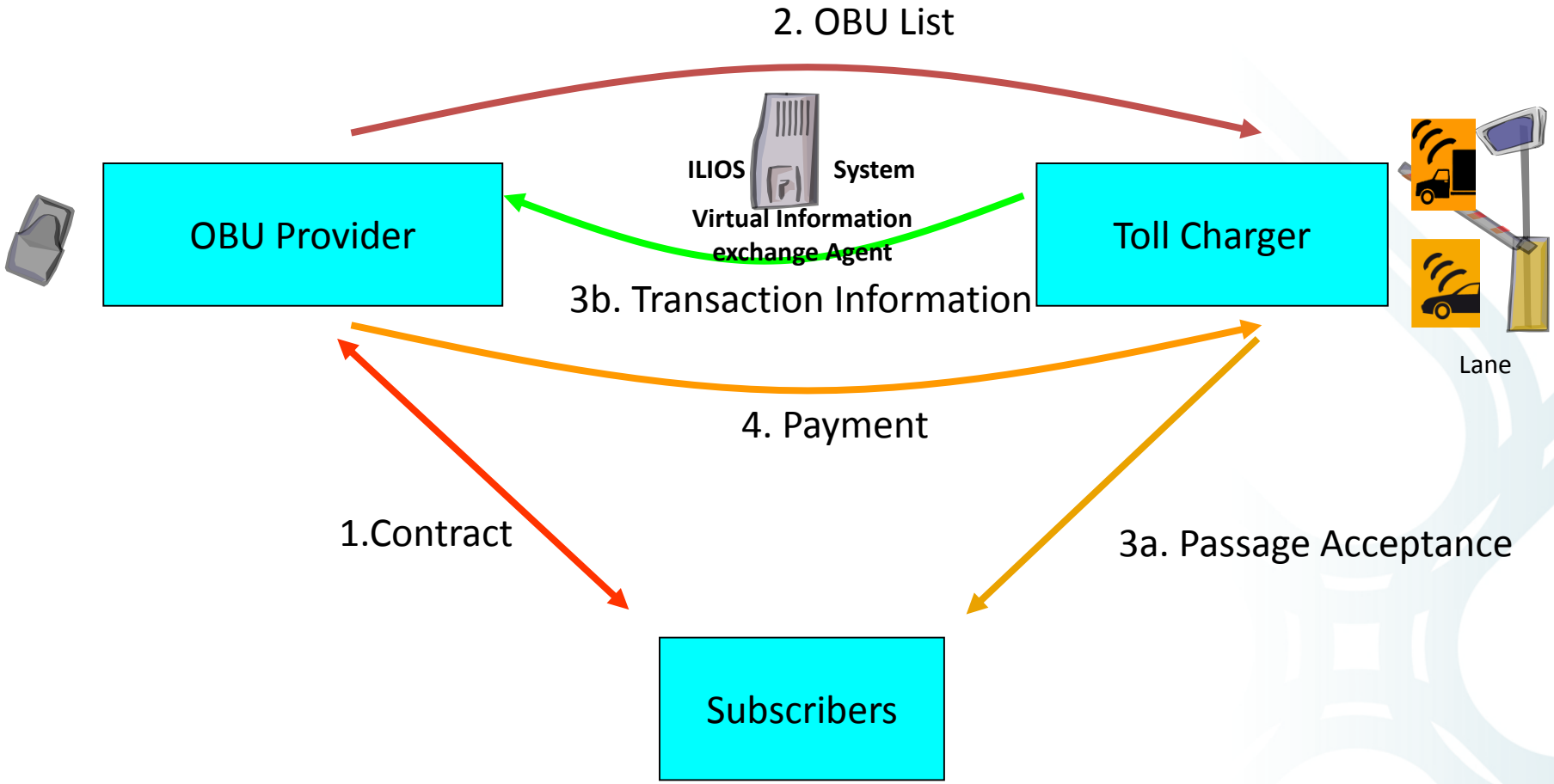
+**No single point of failure** In case one of the Peer systems faces an issue the rest operate normally

+More **secure and transparent** since no Party has access to all peer data

+**No additional personnel or facilities** required, each party performs its tasks in-house

+Built on the **experience of pre-existing** one-way Interoperability schemes

Technical Solution 2/3
GRITS Logical Diagram



Technical Solution 3/3
Information flow Diagram

ILIOS: Interoperability Logical Interface fOr GRITS Service

Peer to Peer Architecture with Middle Tier data exchange

- **Local Toll Systems interface with Local ILIOS Middle Tier System**

- **Middle Tiers interface between** them with redundant communication lines

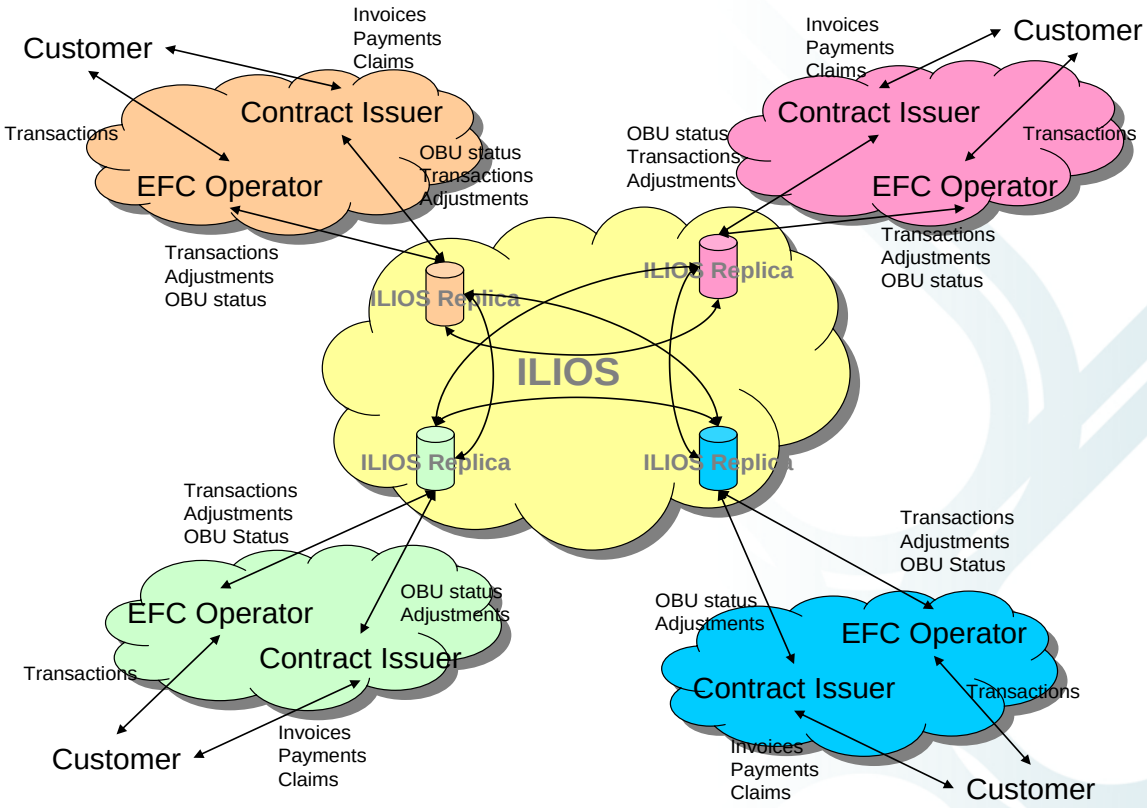
- **Middle Tier Databases replicated at each site**

- **Near real time (a few minutes) list and transaction transfer**

- **Only list changes (deltas) are exchanged as they become available, to reduce update time**

- **Automatic Daily Reconciliation**

- **Real time monitoring and alerting**



Evolution of ETC after one year with GRITS 1/5
Customer Base Identity

- **92% of tags belong to Attiki Odos (Athens Ring Road) Customers, who keeps a dominant position in the market**
- **Provision of GRITS service did not significantly increase the customer base (tag distribution)**
- **Customer Base expansion mainly dependent on provision of discount plans by Toll Chargers in the local networks and normal market presentation rather than on interoperability**

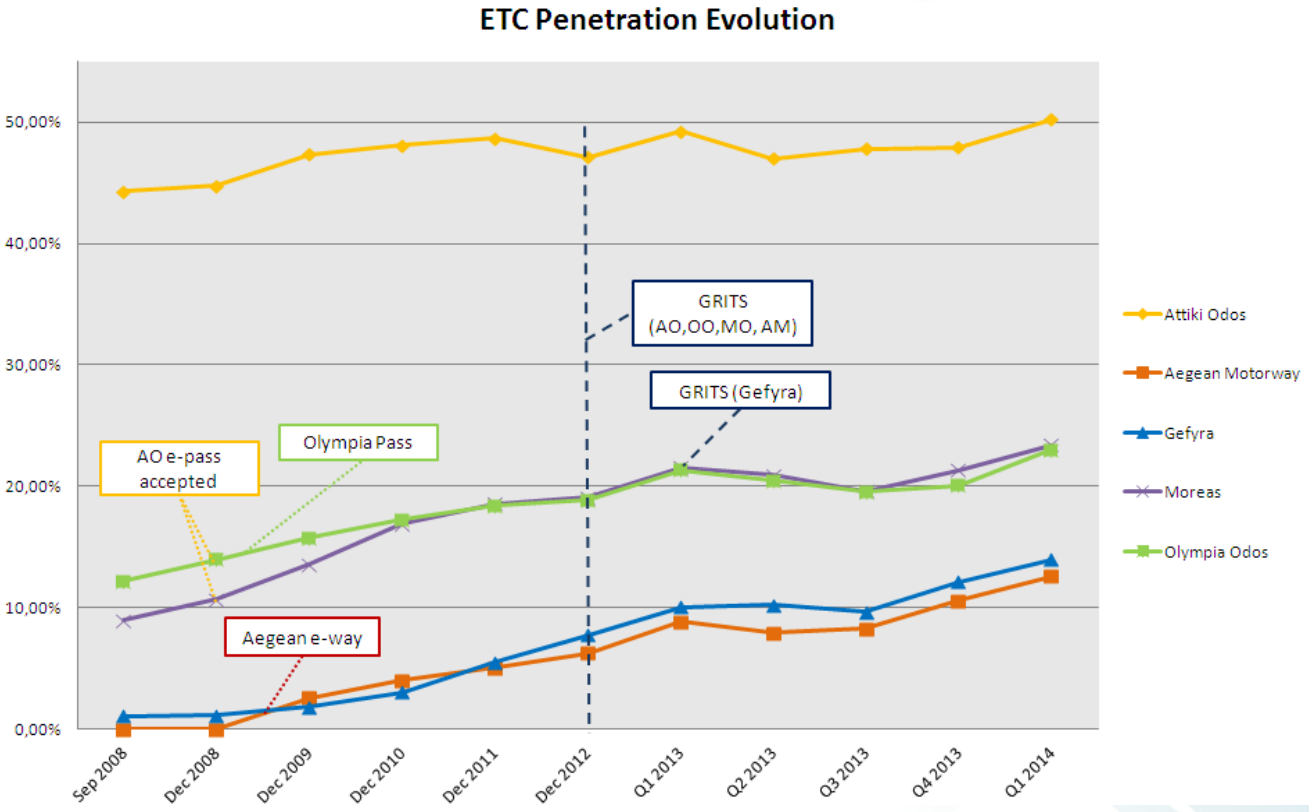
Transponders Distributed (Thousands)					
Issuer	Attiki Odos	Aegean Motorway	Olympia Odos	Gefyra	Total
Before GRITS	Nov 2012	Nov 2012	Nov 2012	Mar 2013	
	489,7	11,8	16,0	3,3	520,8
After GRITS	Mar 2014				
	507,9	16,8	20,4	4,1	549,2
Difference	18,2	5	4,4	0,8	28,4
Difference %	3,7%	42,4%	27,5%	24,2%	5,5%

Evolution of ETC after one year with GRITS 2/5
ETC penetration Before and After GRITS

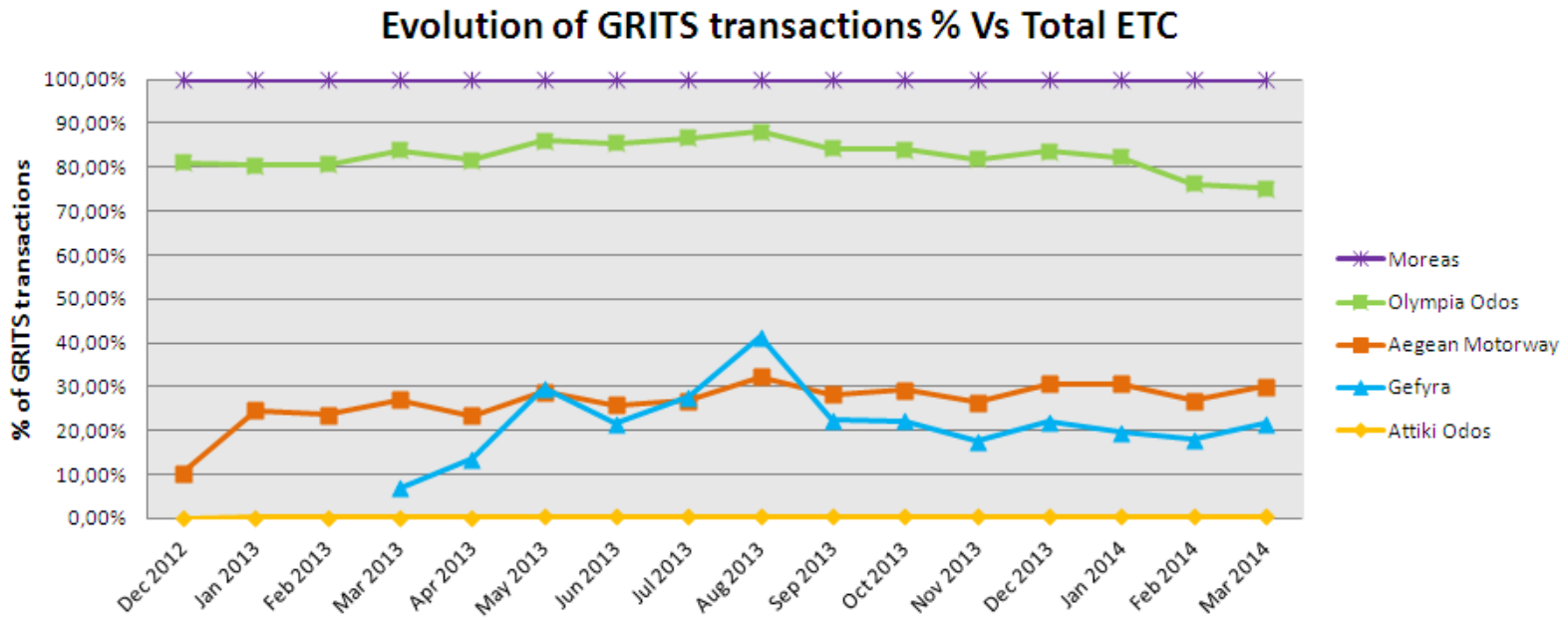
➢**ETC penetration increase:**
✓**Aegean Motorway 50%**
✓**Gefyra 20%**
Due to non prior acceptance of other than native tags

➢ **ETC penetration slight increase:**
✓**Olympia Odos & Moreas** Due to pre-existing acceptance of Attiki Odos Tags and high ETC penetration due to one way interoperability

➢ **ETC penetration stable:**
✓**Attiki Odos**
Due to pre-existing high ETC penetration of native tags and small transaction volume of new tags accepted



Evolution of ETC after one year with GRITS 3/5 Interoperable Transactions



➢ **Olympia Odos:**
Over 80% of ETC transactions are from other issuer tags, mainly Attiki Odos. Recent drop (Feb 2014) due to implementation of discount plans for Olympia Pass subscribers

➢ **Aegean Motorway and Gefyra:** Stable increase of GRITS transactions, with seasonal variations

➢**Attiki Odos:**
GRITS transactions less than 0.5% of total ETC, due to large number of native tags

➢**Moreas:**
all ETC transactions are from GRITS tags (no native tag)

Evolution of ETC after one year with GRITS 4/5 Benefits

- **Operational Benefits**
  - ✓ **Significantly Increased ETC penetration**, especially in projects without any previous Interoperability Schemes or with low native ETC penetration
  - ✓**Reduced Operation Costs** due to smaller number of manual lanes required for operation.
  - ✓**Higher plaza throughput** ETC lanes throughput has been recorded at values over700 vehicles /hr compared to maximum manual lane throughput which ranges from 250 to 330 vehicles/ hr depending on toll rates

- **Benefits to Customers**
  - ✓ **Faster- non-stop transactions**
  - ✓ **No need in the vast majority of cases to have multiple contracts and multiple tags**

So has the "One Tag- One Contract" service been fully achieved?

Evolution of ETC after one year with GRITS 5/5
Areas for Service Improvement

YES for the vast majority of Customers, but with some exceptions:

➢**The GRITS Network does not cover all Greek motorways –** Users still require 3 different transponders to travel from Athens to Thessaloniki (any GRITS tag, Nea Odos fast Pass, TEO-Pass)

➢**Discount plans are diverse and non interoperable –** In order for users who frequently use 2 neighboring networks (e.g Olympia Odos and Attiki odos) need to have 2 contracts and 2 tags in order to benefit from discount plans available in the 2 networks

Discount Policies applicable in different networks

Attiki Odos	Aegean Motorway	Gefyra	Olympia Odos
Flat discounts for Light and Heavy Vehicles	Scalable discounts based on frequency & plaza for Light Vehicles (6 different programs for 6 separate plaza groups)	Scalable discounts based on frequency for all vehicles except buses.	Scalable discounts based on frequency & plaza for Light Vehicles (3 different programs for 3 combinations of plaza groups in completed motorway section Elefsina Korinthos)
Frequency based discounts for Light and Heavy Vehicles	Flat discounts for Light and Heavy Vehicles in two specific mainline plazas		Flat discounts based on user place of residence for light vehicles in specific plazas in completed motorway section Elefsina- Korinthos
			Flat discounts for Light and Heavy vehicles in motorway section under construction (Korinthos Patra)

Next Steps
How to make GRITS more attractive to users?

1. **Expansion of GRITS network to National Level (i.e. Nea Odos, Kentriki Odos, Egnatia Odos)**

2. **Interoperable Discount plans - How to improve the service towards the user? (Pros/Cons, +/-)**

Option A. Fully Interoperable Discount plans – all discount plans to be applied with all tags (not only native)

- Very complex to implement technically since discounts are calculated at the tag issuer's level (where account is maintained), so tag issuer's system must embed all the discount calculation principles available in toll charger's networks
- Very complex to implement at the commercial & contractual level since discount plans differ significantly and are governed by diverse terms & conditions as well as eligibility constraints.

Full interoperability of discount plans is generally not available in worldwide applications

Option B. Common flat discount rate for all ETC transactions on all motorways

+ Easier to implement since all it requires are different fare schedules for ETC compared to cash
– Very High impact on revenue
– Financial and Contractual implications on projects

Option C. One tag multiple contracts - Users could register a single tag with multiple contracts in the required service providers

+ Easier to implement (still requires significant technical modifications)
– Still requires multiple contracts

"One Tag Multiple Contracts" approach is the most viable approach for further investigation

Conclusions

- GRITS Service – successful after 1st year of Operation
- Significant Operational Benefits – ETC penetration, lower costs, higher [plaza capacity
- Significant benefits to customers – faster transactions, less stops, less hassle for virtually all GRITS network ETC customers
- System extremely reliable, over 9.03 million interoperable transactions handled until March 2014 out of 57.77million ETC transactions in GRITS network
- Need to expand service country wide
- Need to further examine ways to make the service more user-friendly for customers who wish to take advantage of multiple discount plans in different motorways without multiple tags

Thank you for your attention

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