(S//SI//REL) **Project Overview:** The mission of the AURORAGOLD (AG) project is to maintain data about international GSM/UMTS networks for the Wireless Portfolio Program Office (WPMO), the Target Technology Trends Center (T3C/SSG4), and their customers. Analysis of this data supports:

a) An understanding of the current state,

b) Trending, or time-series analysis, from the past through to the future, and
c) Forecasting of the evolution of global GSM/UMTS-based networks.

This analysis and developmental activity is currently focusing only on GSM/UMTS infrastructure, voice-data convergence, UMTS technology migration, and UMTS technology deployments. Coincident beneficiaries of this mission are, among others, other NSA SIGDEV elements, protocol exploitation elements, and Five-Eyes Partner SIGDEV organizations.

(C//REL) **Alignment:** Supports NSA’s and SID’s imperative to “Know the Future.”

(C//REL) **Sponsors:** WPMO/S3W

(C//REL) **Customers:** WPMO/S3W; T3C/SSG4; Various S3 collections organizations; numerous IC organizations

(C//REL) **Architecture and Infrastructure:** Custom-built application based on OZONE framework, using GOLDENCARRIAGE corporate servers for all application and data storage.
(S//SI//REL) Corpus:
Will contain:
• Unclassified: Complete replica of Informa Telecoms and Media’s World Cellular Information Service (WCIS) queryable database to eventually compare data against that collected from SIGINT
• Classified: SIGINT-collected IR.21 (International Roaming agreements) documents from around the world, parsed of their information, analyzed, and giving users the ability to trend this information over time (time-series analysis). In addition, e-mail selectors from within IR.21s and from SIGINT metadata captured, analyzed and managed back into the SIGINT system for enhanced collection

(C//REL) Content:
• Portion of the WCIS data available via NSANet GUI; remainder to be completed within 2-3 months
• Currently, Phase 1 contains a small database of worldwide wireless networks being compared against IR.21s from SIGINT to establish our “baseline”

(C//REL) Capabilities:
• Soon, complete WCIS repository to be copied to NSANet for querying by all NSA and 2P Partners
• Later, agile querying through entire IR.21 and WCIS databases, with capability to perform time-series analysis via visualization application
This mission of the AURORAGOLD (AG) project is to maintain data about international UMTS networks for the Wireless Portfolio Program Office (WPO), the Target Technology Trends Center (TTTC), and their customers. Analysis of this data supports:

a) An understanding of the current state,
b) Trending, or time series analysis, and
c) Forecasting of the evolution of global UMTS-based networks.

This analysis and development activity will focus on UMTS infrastructure, voice-data convergence, UMTS technology migration, and UMTS technology deployments. Considerable byproducts of this mission are, among others, other NSA SIGDEV elements, protocol exploitation elements, and Five-Cygnus Partner SIGDEV organizations.
Demonstration Script

• (Only capability currently available is basic querying against small portion of WCIS database)
• Go to
• Click on any of the brown boxes
• Select your search criteria
• Select your query result criteria
• Click “Submit”
• View the results
(U//FOUO)

AURORAGOLD

Target Technology Trends Center/T3C
support to WPMO

Overall briefing classification: S//SI//REL TO USA, FVEY
Two synergistic efforts:
Trending and forecasting of global wireless and cellular networks

**AURORAGOLD**
- Data gathering and analytics on GSM/UMTS networks

“Auto”-Minimization
- Automated minimization capability to ensure compliance with NSA reporting policy
AURORAGOLD DATA FLOW & PROCESS OVERVIEW
(U//FOUO)

**AURORAGOLD Repository**

1. WCIS (Unclassified Data Source)
2. ITU Ops Bulletin (Unclassified Data Source)
3. IR.21 (Classified Data Source)

**Data Parsing/Extraction**

**Raw Data Sets – Unclassified**

- Analysis By Exception; Some Analytic Decisions
- Exception Decision Information

**Raw Data Sets – Classified**

- Analysis By Exception; Some Analytic Decisions
- Exception Decision Information

**Analyzed Data Sets – Unclassified**

**Analyzed Data Sets – Classified**

**Supplementary Outputs:**
1. Strong Selector and Tasking Management
2. Some selectors back to AGR inputs for tasking
3. Information outputs to other systems (i.e. RONIN)
4. Other??

**QUERYING**

1. File Outputs
2. All Users
3. All Appropriately Cleared Users

**VISUALIZATION**

1. SCORPIOFORE; SIGINT Reporting
2. "AUTO" - MINIMIZATION

**S//SI//REL TO USA, FVEY**
AURORAGOLD DATA FLOW & PROCESS OVERVIEW: PHASES 0 AND 1
(U//FOUO)

Supplementary Outputs:
1. Strong Selector and Tasking Management
2. Some selectors back to AGR inputs for tasking
3. Information outputs to other systems (i.e. RONIN)
4. Other??

S//SI//REL TO USA, FVEY
AURORAGOLD DATA FLOW & PROCESS OVERVIEW
(U//FOUO)

Supplementary Outputs:
1. Strong Selector and Tasking Management
2. Some selectors back to AGR inputs for tasking
3. Information outputs to other systems (i.e. RONIN)
4. Other??

S//SI//REL TO USA, FVEY
AURORAGOLD

NOW:

• GSM technology family from unclassified data
• Parsing IR.21 documents from SIGINT
• Basic analytics
• Basic auto-sourcing

FUTURE:

• Additional fields
• Additional sources
• Entity normalization
• Complex analytics
• Advanced auto-sourcing
• "Auto"-Minimization
• SCORPIOFORE reporting
• Visualizations enabling time-series analyses

RISKS:

• Data sources and ingest
• Expanding capability to other wireless technologies
(U//FOUO) AURORAGOLD is a team of SSG4 analysts, developers and wireless SMEs working on:

- (S//SI//REL) Database of Mobile Network Operators (MNOs), networks, and PWIDs collected from GSM/UMTS/LTE roaming documents (IR.21s),
- (S//SI//REL) Target development effort against MNOs, roaming hubs, and GSM Association (GSMA) working groups, and
- (U) Fusion of open source, licensed, commercial data with SIGINT to answer wireless needs.

(S//SI//REL) Sample SIGINT (IR.21) Queries

- (S//SI//REL) What IR.21s have we seen for networks within a country or set of countries?
- (S//SI//REL) What IR.21s have we seen for networks managed by a mobile network operator?
- (S//SI//REL) What IR.21s have we seen for a particular network or set of networks?

(U) Sample Open Source (Licensed Commercial Data) Queries

- (S//SI//REL) What are all of the cellular network operators within a country currently in service?
- (S//SI//REL) What suppliers have sold equipment to which operators within a country?
- (S//SI//REL) What networks are currently in service/planned within a country for each operator?
- (S//SI//REL) Which network technology equipment exists within a country for each operator?
• (S//SI//REL) What is the network name for each network within a country for each operator?

• (S//SI//REL) When was each network placed into service for each operator within a country?

• (S//SI//REL) What cellular network technology (e.g., GSM, W-CDMA, HSPA, etc.) is in service for each operator in a country?

• (S//SI//REL) Which frequency spectrum bands are being used by which operators in a country?

• (S//SI//REL) What 4G/LTE networks are currently in service/planned for each operator within a country?

• (S//SI//REL) What CDMA or CDMA Wireless Local Loop networks are currently in service/planned for each operator within a country?

• (S//SI//REL) What network license auctions are planned within a country?

Derived From:
NSA/CSSM 1-52
Dated: 20070108
### (S//SI//REL) Some IR.21 Fields Useful to SIGINT

<table>
<thead>
<tr>
<th>(U) IR.21 Field</th>
<th>(U) What is it?</th>
<th>(U) How is it used?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobile Country Code (MCC)/Mobile Network Code (MNC)</strong></td>
<td>(U) A decimal digit code which uniquely identifies a mobile network. The MCC which identifies the country is used as the first three digits of any user’s IMSI, followed by the two digit MNC which identifies the network within that country.</td>
<td>(U) Provide unique identification of networks to identify network boundaries, interfaces, protocols, software, hardware, etc.</td>
</tr>
<tr>
<td><strong>Mobile Subscriber Integrated Services Digital Network Number (MSISDN)</strong></td>
<td>(U) A number uniquely identifying a subscription in a GSM or a UMTS mobile network (the telephone number to the SIM card in a mobile/cellular phone).</td>
<td>(U) Allow identification of real phone number dialed</td>
</tr>
<tr>
<td><strong>TADIG codes</strong></td>
<td>(U) A number allocated by the GSMA for use as primary identifiers, both within file contents and file names. Also used as a more generic entity identifier in the mobile industry</td>
<td>(U) Identify the network for billing purposes and help identify targets</td>
</tr>
<tr>
<td><strong>Signaling Connection Control Part (SCCP)</strong></td>
<td>(U) A network layer protocol that provides extended routing, flow control, segmentation, connection-orientation, and error correction facilities in Signaling System 7 telecommunications networks</td>
<td>(U) Provides routing information within the Public Land Mobile Network and provides access to applications such as 800-call processing and calling card processing to identify targets and other information</td>
</tr>
<tr>
<td><strong>Subscriber Identity Authentication</strong></td>
<td>(U) This field indicates whether or not authentication is performed for roaming subscribers at the start of GSM service and the type of A5 cipher algorithm version in use.</td>
<td>(S//SI//REL) It would also show the emergence of new cipher algorithms and support target analysis, trending and the development of exploits.</td>
</tr>
<tr>
<td><strong>Mobile Application Part (MAP)</strong></td>
<td>(U) A SS7 protocol which provides an application layer for the various nodes in GSM and UMTS mobile core networks and GPRS core networks to communicate with each other in order to provide services to mobile phone users. The Mobile Application Part is the application-layer protocol used to access the Home Location Register, Visitor Location Register, Mobile Switching Center, Equipment Identity Register, Authentication Centre, Short message service center and Serving GPRS Support Node (SGSN).</td>
<td>(S//SI//REL) Provides a clearer understanding of network features when roaming agreement information is published. Current information about subscribers, mobility management and applications can be used for targeting and target development.</td>
</tr>
<tr>
<td><strong>Network Element</strong></td>
<td>(U) Specific network components, their manufacturer, software &amp; hardware versions, etc.</td>
<td>(S//SI//REL) This specific information is necessary for targeting and exploitation. Includes core and</td>
</tr>
<tr>
<td>Information</td>
<td>Packet Data Services Information</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>(U) Packet Data Services identifies the affected GPRS networks. An Access Point Name is also included in this information. APNs can identify the type of service provided by GPRS networks provided to mobile users. APNs also help identify the network and operator's packet network involved in the IR.21 and could be used for targeting.</td>
<td>(S//SI//REL) This data element also provides information on the WAP gateway being access and multimedia messaging services gateway IP addresses which is useful for target development. Insight into the GPRS Tunneling Protocol versions being used within the networks is provided as well. GPRS, EDGE and HSPA technologies are covered.</td>
<td></td>
</tr>
</tbody>
</table>
(U//FOUO) AURORAGOLD Working Group

(S//SI//REL) Shaping understanding of the global GSM/UMTS/LTE landscape

SIGDEV Conference – 6 June 2012
Agenda

- (U//FOUO) What is AURORAGOLD?
- (U) Why come to us?
- (U) Our value proposition...
  - (S//SI//REL) Primary source mobile network information
  - (S//SI//REL) First-hand insight into industry changes
- (U//FOUO) Targeting efforts
- (U) Notable successes
- (U) Future plans
- (U) Discussion!
What is AURORAGOLD?

(U) Team of analysts, developers, and wireless SMEs working on:

- (S//SI//REL) Database of Mobile Network Operators (MNOs), networks, and PWIDs from collected GSM/UMTS/LTE roaming documents (IR.21s)

- (S//SI//REL) Target development effort against MNOs, roaming hubs, and working groups

- (U) Fusion of open source, commercial data with SIGINT to answer wireless needs
Why come to us?

- (S//SI//REL) Extensive, global IR.21 data vetted by SSG4 analysts:
  - 701 networks of estimated 985 (as of 15 May 2012)
  - First-hand SIGINT information direct from MNOs
- (S//SI//REL) Most comprehensive set of IR.21-related email selectors and keyword-based tasking:
  - 1201 actively managed email selectors (as of 15 May 2012)
- (U//FOUO) Foundation for worldwide mobile wireless network trending and forecasting
  - Includes visibility into changing industry standards and practices
(S//SI//REL) Example: “AFRICOM IKD-OPS requires information concerning the SMS Gateway domains for: Libyana mobile (libyana.ly) and Al Madar Al Jadid (almadar.ly). We believe these are the only two mobile providers in Libya but if you have information to the contrary please let us know.”

3 March 2011
We’ve done the research

• (S//SI//REL) Quickly identified collected IR.21s
• (U//FOUO) Pushed information out to customer through product reporting

DOCN 000028528
ZNY ZNY MMIVX
ZKZK ZKZK RR SOL DE
PDTG R 162037Z MAR 11
FM FM DIRNSA
CLAS TOP SECRET UMBRA US/UK/CAN/AUS/NZ EYES ONLY QQQQ
XXMM XXMMENP01FOO11075

SERI SERIAL: 3/00/506998-11
TAGS TAGS: LIC CCOM CLOG COEF CORG CPER CTEC CTPH LI
SUBJ SUBJ: Libya/Telecommunications: Two Libyan Mobile Phone Companies Provide Updated Network Information, June and December 2010 (S//SI//REL TO USA, FVEY)
### Vendor Information

<table>
<thead>
<tr>
<th>Component</th>
<th>Vendor</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSS vendor(s) and SW/HW version</td>
<td>Ericsson</td>
</tr>
<tr>
<td>HLR vendor(s) and SW/HW version</td>
<td>Ericsson</td>
</tr>
<tr>
<td>MSC/VLR vendor(s) and SW/HW version</td>
<td>Ericsson</td>
</tr>
<tr>
<td>SMSC vendor(s) and SW/HW version</td>
<td>Alcatel-Lucent V 3.1</td>
</tr>
<tr>
<td>SGSN vendor(s) and SW/HW version</td>
<td>Ericsson R7</td>
</tr>
<tr>
<td>GGSN vendor(s) and SW/HW version</td>
<td>Ericsson R4</td>
</tr>
<tr>
<td>MMS vendor(s) and SW/HW version</td>
<td>Ericsson MMC 5.0</td>
</tr>
<tr>
<td>IN vendor(s) and SW/HW version</td>
<td>Alcatel-Lucent</td>
</tr>
</tbody>
</table>

### SMSC Information
- SMSC GT addresses:

### MMS Interworking Information
- Domain name of MMSC
- IP address range for MMSC
- IP address(es) of incoming MTA
- IP address(es) of outgoing MTA
- Max. size of MMS allowed
- Delivery Report allowed?
- Read Report allowed?
- Contact person(s) for IW MMSC: (optional field)
- MMS IW Hub Provider(s) GT addresses:
- MMS IW Hub Provider(s) Name(s):

Extracted from 3/00/506998-11
We monitor the industry

• (S//SI//REL) Visibility into changing standards and practices for:
  – Roaming
  – Signaling
  – Billing
  – Interoperability

• GSM Association (GSMA), a Swiss association that drives the GSM/UMTS/LTE space
Roaming Agreement EXchange (RAEX)

- (U) Next-generation roaming exchange process
- (U) Well-defined XML schemas instead of semi-structured data in multiple formats
- (U) Email likely gives way to SSL sessions with central server(s)
Targeting Efforts

- (S//SI//REL) MNO roaming coordinators, hubs, GSMA working groups, ROAMSYS
- (S//SI//REL) ~100% of MNOs in WPMO’s Top 20

<table>
<thead>
<tr>
<th>Category</th>
<th>Contains...</th>
<th>Tag</th>
<th>Contains...</th>
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</thead>
<tbody>
<tr>
<td>4002</td>
<td>IR21 senders/receivers</td>
<td>AGIR21</td>
<td>IR21 senders/receivers</td>
</tr>
<tr>
<td>3918</td>
<td>GSMA and SIGDEV</td>
<td>AG_USER</td>
<td>Individual (usually sender)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AG_ALIAS</td>
<td>Alias (usually receiver)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AGRAEX</td>
<td>RAEX working groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCC/MNC [###][###]</td>
<td>IR21 s/r for given network</td>
</tr>
<tr>
<td></td>
<td>roaming hub</td>
<td>AGRAEX</td>
<td>Roaming hub contacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Notable Successes

- (TS//SI//REL) Characterization of IR.21 collection from 67 high-priority networks (DSD)
- (TS//SI//REL) Most recent IR.21s from Egypt (S2E)
- (S//SI//REL) Assessment of IR.21 collection related to a possible new Chinese network (S2B)
- (S//REL) Sole source of IR.21 collection, ingest, and processing for RONIN; >200% improvement (NAC)
- (S//SI//REL) Working toward enterprise sharing of licensed, commercial data
  - Today: WiMAX data with JUBILEE CORONA (S3516)
- (TS//SI//REL) Reporting on GSMA standards and practices
Future Plans

• (S//SI//REL) RAEX IR.21 collection and ingest providing more query possibilities including:
  – LTE information
  – Technologies/Equipment
  – Frequencies
• (S//SI//REL) AURORAGOLD user interface enabling SIGINT production chain access for querying and trending
• (S//SI//REL) NKB partnership
Discussion

• (S//SI//REL) What are your ideas, suggestions, and analytic needs with respect to:
  • roaming and network information discovery and development?
  • GSMA’s standards setting activities?

• (S//SI//REL) What are we missing? Are there data elements we should seek out to help meet your needs?
Work with us!

- (U//FOUO) To contact the AURORAGOLD team with an RFI, please use GLOBAL TIPPER "go GT"

- (U//FOUO) WikiInfo: "wi AURORAGOLD"

- (U//FOUO) Email: [UNCLASSIFIED//FOR OFFICIAL USE ONLY]
(U//FOUO) AURORAGOLD

(U) BACKUP SLIDES
<table>
<thead>
<tr>
<th>Serial</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/00/506998-11</td>
<td>(S//SI//REL) Libyan MNO information</td>
</tr>
<tr>
<td>3/00/556211-11</td>
<td>(S//SI//REL) Launch of RAEX; ROAMSYS and GSMA</td>
</tr>
<tr>
<td>3/00/515656-12</td>
<td>(S//SI//REL) GSMA standards releases/changes for 2012 (RAEX IR.21 and others)</td>
</tr>
<tr>
<td>2/00/502330-12</td>
<td>(S//SI//REL) GSMA database of Type Allocation Codes (TACs)</td>
</tr>
</tbody>
</table>
GSMA Working Groups

(U) Known as of 10 May 2012
# IR.21 Data Extraction

## (U) Content

<table>
<thead>
<tr>
<th>Field</th>
<th>AG</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCC/MNC</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Operator name</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Operator country</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Email addresses</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Access point information</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Autonomous system number</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>DNS names &amp; IPs</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Inter PLMN backbone IPs</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>GPRS Roaming Exchange (GRX)</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

## (U) Metadata/SRI

<table>
<thead>
<tr>
<th>Field</th>
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<th>R</th>
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</thead>
<tbody>
<tr>
<td>SIGAD</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Case notation</td>
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</tr>
<tr>
<td>PWID</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>PINWALE Date Time Group</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>PINWALE category &amp; keywords</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Email “From” &amp; date</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Source &amp; destination IP</td>
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<td></td>
</tr>
<tr>
<td>Filename</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>PDDG</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
Metrics: Network Discovery

(S//SI//REL) GSM/UMTS/LTE Networks Discovered in SIGINT

Graph showing the increase in networks discovered from 2009-11 to 2012-04.
Metrics: Network Discovery

(S//SI//REL) GSM/UMTS/LTE Network Coverage

- 701 confirmed
- 985 estimated
- 71%

(as of 15 May 2012)
Network Coverage
Metrics: Tasking

(S//SI//REL) Strong Selector Targeting

<table>
<thead>
<tr>
<th>Year</th>
<th>Net change in tasking</th>
<th>Total tasked</th>
<th>Extracted from IR.21s</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-11</td>
<td>363</td>
<td>363</td>
<td>564</td>
</tr>
<tr>
<td>2011-12</td>
<td>1</td>
<td>364</td>
<td>1040</td>
</tr>
<tr>
<td>2012-01</td>
<td>782</td>
<td>1146</td>
<td>527</td>
</tr>
<tr>
<td>2012-02</td>
<td>206</td>
<td>1352</td>
<td>517</td>
</tr>
<tr>
<td>2012-03</td>
<td>2</td>
<td>1354</td>
<td>785</td>
</tr>
<tr>
<td>2012-04</td>
<td>-143</td>
<td>1211</td>
<td>711</td>
</tr>
</tbody>
</table>
RAEX Adoption in SIGINT

(S//SI//REL) What we've seen so far...

5%

(S//SI//REL) 36/699 networks
(Apr 2012; AURORAGOLD)

(TS//SI//REL) What we expect...

21%

(TS//SI//REL) 202/985 networks
(19 Apr 2012; 3/OO/515656-12)
Network Tradecraft Advancement Team (NTAT) 3G

- 2nd SCAMP at CSEC process

- Worked with CSEC H3 developers to implement IRASCIABLE RABBIT into OLYMPIA
- Developed 41 use cases
- Developed 10 new working aids
- Identified 3 new QFDs
- Research conducted on GRX operators over VPN (QFD: IRASCIABLE HARE)
- Progressed IR21 sharing and analysis
- Explored other GSMA Association for network intelligence
- Progressed signalling over IP analysis (QFD: BOLSHIE POSSUM)
- MNO EEI target template in development
- Identified training scenario
- Conducted real-world training scenario
- Tied together target analysis to network analysis process
- Use cases and working aids follow a layered template
- Research conducted on clearing house operators – identified key documentation and selectors
- Explored the usefulness of IR21 processing – decided against this
- Integrated TOYGRIPPE analysis into OLYMPIA
- Streamlined identification of VPNs of interest for crypt analysis

http://
IR.21 – A Technology Warning Mechanism

SSG4/T3C Technical Director

Derived From: NSA/CSSM 1-52
Dated: 20070108
Declassify On: 20341201
This briefing is classified:

TOP SECRET//COMINT//REL TO USA, FVEY//
Today’s Agenda

- (U) Emerging Operating Model for Trends and Forecasting
- (U) Wireless Evolution Paths

- (S//REL TO USA, FVEY) Analytic Framework
- …and Process

- (S//REL TO USA, FVEY) Meet AURORAGOLD

- (U) An Invitation to Join – Your Use Cases…
  - Includes Home Work Assignments …
Effective Forecasting: Geopolitical Regions and Targets

- What geographies are of national interest to our customers?
- What organizations and individuals must we target to answer our customers’ questions?
- How does those targets communicate?
- How is technology evolving?
- How are technology and telecoms evolving in regions of interest?
- How do we expect targets to use emerging technologies?
- What is the SIGINT threat of these emerging technologies?

- What vulnerabilities are critical to current success (i.e. where are our risk areas)?
- How do we discover vulnerabilities?
- How do we introduce vulnerabilities where they do not yet exist?

- What capabilities do we need to develop to take advantage of technology vulnerabilities?
- What techniques do we deploy to take advantage of those vulnerabilities (e.g. CNE, supply chain, mid-point, etc.)
- What role does enabling, cooperative access, HUMINT, 2nd parties, etc. play in building those capabilities?
(U) Two Types of Investigations

- **Horizon Scanning**
  - Objective: Initial identification and assessment
  - All source research
  - Answer the question: Does this technology appear to be a large risk to the SIGINT system? Why or why not?

- **Deep Dive**
  - Objective: Cause a funding decision(s)
  - All source research; emphasis on geographic uptake trends; target uptake plans or vignettes.
  - Answer the question: Are SIGINT targets taking up this technology? How fast?
  - Implicitly contrast the above with the cost and time needed to remediate any SIGINT system shortfalls.
(U) Trends and Forecasts: A Geo-temporal Tracking Problem

- **Forecast:**
  - “An estimation of a Future Condition” …
  - “To calculate or predict some future event or condition usually as a result of the analysis of available pertinent data” – Merriam Webster

- **Trend:**
  - “To extend in a general direction; follow a general course”
    
    – Merriam Webster

- **By necessity, a trend-line requires measurement of understood variables across time.**
Roaming Agreements

- Allow a mobile subscriber to use resources on a visited network

Each carrier’s IR.21 is a technical document that:

- Describes the operator itself in various ways
  - Location, business codes, etc.
- Describes access to the IP network of the operator
  - DNS, IP addresses, ASN, etc.
- Describes:
  - Radio Access Network: technology(ies) type(s)
  - Frequency(ies)
  - Telephony routing information (MSISDN ranges; E.212)
  - SCCP gateways (Point codes)
  - Mobile Application Part protocol in use
  - Hardware, software versions of certain network elements…

Hypothesis: We can identify and track a carrier’s technical evolution with IR.21 and other data.
3G Wireless Standards Evolution – Overview

**3GPP2**
- IS-2000 (CDMA 2000 1x)
- IS-856 Rev 0 (1xEV-DO)
- IS-856 Rev A (Optimized UL & VoIP)
- IS-856 Rev B (MC, 64QAM)
- IS-1006 (BCMCS)
- IS-1006-A (EBCMCS)
- IS-856 Rev C (MIMO/SDMA, DO Enhancements, 1x-adv)

**3GPP**
- R-99 (UMTS)
- Rel-5 (HSDPA)
- Rel-6 (E-DCH, MBMS)
- Rel-7 (Enhanced HSDPA)
- Rel-8 (LTE DC HSPA)
- Rel-9 (more LTE features)
- Rel-10 (LTE-ad)

**IEEE/WiMAX Forum**
- Rel-5 (HSDPA)
- Rel-6 (E-DCH, MBMS)
- R-99 (UMTS)
- Rel-7 (Enhanced HSDPA)
- 802.16 (WiMAX)
- 802.16a
- 802.16d
- 802.16e Wave1&2
- 16e Rev. 2 Rel 1.5
- 802.16m Rel 2.0

**Note:**
- Dates shown are standards completion dates (or expected completion dates.)
- “Initial VoIP” not as spectrally efficient as “Optimized VoIP”.
- “Mobility” indicates when each particular standard supports mobility inter-operability between the terminal and BTS.
And What About 4G?

- IMT-adv is an ITU led effort to set requirements for next gen. mobile networks
  - Just as ITU’s IMT-2000 defined 3G, ITU’s IMT-adv will define 4G

Proposed 3GPP Work Plan
Framework for Analysis...

- **3GPP**: Defines technology migration paths.
  - “Releases” – A Clear Technology Roadmap
    - 3G begins with Release 99
    - Other releases: 04, 05, 06, 07, 08, 09, …, 10, 11 (future)
      - See: [www.3gpp.org/ftp/Information/WORK_PLAN/Description_Releases/](http://www.3gpp.org/ftp/Information/WORK_PLAN/Description_Releases/)
    - Releases cover:
      - **Access**: GSM, EDGE, HSPA, LTE, LTE-Advanced, etc.
      - **Core**: GSM Core, Enhanced Packet Core...
      - **Services**: MS, etc.

- **GSMA**: Defines carrier information exchange required to enable roaming
  - Changes to IR.21 format warn of imminent technology roll-out
  - An IR.21 is a GSMA-mandated document. IR.21 are exchanged between Wireless operators with roaming agreements, to the GSMA, and to certain clearing house operations.
**Analytic Process**

- **Data analysis process is to match information in IR.21, or elsewhere, against Releases in the Technology Roadmap**
  - Example: CAMEL Phase 4 (aka CAMEL4) as proxy for Release 5 deployment

- **Analytic goals:**
  - Establish a date-time for a release deployment
  - Track releases at the per network level
  - Display status at the national, regional, hemispheric or global scale
  - Measure speed of adoption at each scale
  - Identify early and late adopter tendencies by network

- **Deliverables:**
  - Adoption trends over time
  - Forecasts derived from trends and framework changes
  - Formal reporting of data and conclusions – as a dataset
**Data Flow and Process Overview**

**WCIS** (Unclassified Data Source)

**ITU Ops Bulletin** (Unclassified Data Source)

**Other** (Unclassified Data Source)

**IR.21** (Classified Data Source)

**Other** (Classified Data Source)

**AURORAGOLD Repository**

**Raw Data Sets – Unclassified**

**Raw Data Sets – Classified**

**ENTITY NORMALIZATION**

**Analysis By Exception; Some Analytic Decisions**

**Exception Decision Information**

**Supplementary Outputs:**
1. Strong Selector and Tasking Management
2. Some selectors back to AGR inputs for tasking
3. Information outputs to other systems (i.e. RONIN)
4. Other??

**Analyzed Data Sets – Unclassified**

**Analyzed Data Sets – Classified**

**VISUALIZATION**

**SCORPIOFORE; SIGINT Reporting**

**“AUTO” - MINIMIZATION**

**File Output**

**Querying**

**All Users**

**All Appropriately Cleared Users**

**SIGINT Production Chain**

21 May 2010

Numbers in red are for reference only
What Is Done Today

1. WCIS (Unclassified Data Source)
2. ITU Ops Bulletin (Unclassified Data Source)
3. Other (Unclassified Data Source)
4. Raw Data Sets – Unclassified
5. Analysis By Exception; Some Analytic Decisions
6. Exception Decision Information
7. All Appropriately Cleared Users
8. SIGINT Reporting
9. VISUALIZATION
10. SCORPIOFORE; SIGINT Reporting

Supplementary Outputs:
1. Strong Selector and Tasking Management
2. Some selectors back to AGR inputs for tasking
3. Information outputs to other systems (i.e. RONIN)
4. Other??

21 May 2010
Information Delivery Vehicles – At NSA

- **Mobile IP Information:**

- **Telephony and Provider information:**

- **Worldwide Wireless Market information:** T3C
  - packaged for WPMO consumption
    - Drives its portfolio investment planning process
    - Affects ~80% of the portfolio (2009), per customer.

- Various and sundry others ...
**Future Implementation**

**AURORAGOLD Repository**

**Raw Data Sets** — **Unclassified**

**Data Sets** — **Unclassified**

**Available to All Authorized Users**

**Available to SIGINT Production Chain**

**VISUALIZATION**

**File Output**

**Querying**

**Scorpiofore; SIGINT Reporting**

**Supplementary Outputs:**
1. Strong Selector and Tasking Management
2. Some selectors back to AGR inputs for tasking
3. Information outputs to other systems (i.e. RONIN)
4. Other??

**21 May 2010**

**Numbers in red are for reference only**
(U) Information – Now What?

- **Make the data useable**
  - Available in or out of the SIGINT production chain
  - Attach flows to value-adding chains and processes
  - Deliver as a data-set
  - Recognize other data sets exist and also are part of analytic processes (federation anybody?)

- **Make the data traceable**
  - Includes auto-sourcing of data origin
  - Time-stamping

- **T3C will do technology trending and warning…**

- **Would your analytic processes benefit from this data set?**
Your Invitation to Join

- **We are few; we welcome partnership.**
  - Can you help?
  - Do you have a better way?
  - Let’s pull together!!

- **We are preparing to measure the breadth of our access to IR.21 documents…**
  - **Goals:**
    - Do we cover all 3GPP networks?
    - Tweak access
    - Tweak selectors
  - Indexer will provide PWID for all identified IR.21, after dedupe.
What Are Your Use Cases?

This is your segment—to make the notetaker’s job simpler please categorize your use case; describe impact:

- A) IP Network
- B) Call Control – Switched Voice
- C) Hardware model and software version information

Group Discussion….
(U) Thank you for your time and contributions
3.6 A5/3 crypt attack proof-of-concept demonstrator

3.6.1 Scope
To successfully prosecute A5/3 enciphered GSM air-interface intercept requires changes to each part of the current A5/1 processing chain. This is a new requirement and has the covername of OPULENT PUP.

3.6.2 Requirements & Acceptance Criteria

<table>
<thead>
<tr>
<th>RFC ST1823</th>
<th>Identifier</th>
<th>CmR</th>
<th>Acceptance Criteria</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-SMP_CmR-xxxx</td>
<td>Trial A5/3 crypt attack hardware</td>
<td>Revalidated IA for OPULANT PUP RFC ST1823</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(TS//SI//REL) Site Makes First-Ever Collect of High-Interest 4G Cellular Signal

FROM: [redacted] and [redacted]
RAINFALL (F78)
Run Date: 02/23/2010

(TS//SI//REL) A collaborative effort between on-site collectors, engineers, and off-site contractors in mid-January 2010 allowed RAINFALL to make what is believed to be the first collection, by any known asset, of Time Division-Long Term Evolution (TD-LTE) 4G (fourth generation) cellular communications. Exploitation of this signal, an all-Internet Protocol successor to 2G and 3G cellular systems, is a very high priority for NSA and the Intelligence Community. The TD-LTE signal will enter the market in 2010 and become globally important by 2012.

(U) For full details, click HERE.

(U//FOUO) Note: A valid PKI certificate with TK clearance is required to access the above article.
<table>
<thead>
<tr>
<th>Strategic Objective</th>
<th>Goal/Aim</th>
<th>Programme Outcomes</th>
<th>Target Capability deliveries for 2011/12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Meet the Mobile Broadband challenge.</td>
<td>Scaling up the exploitation of handsets and Mobile Apps.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provide capability against Mobile encryption</td>
<td>WOLFRAMITE – Definition and prototyping of GSM A5/3 decryption (funding decision to be made (of the order of £4m) probably in 2Q of 11/12)</td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
<td></td>
<td>Respond to the roll out of the next Mobile OTA encryption standard for GSM (A5/3) by developing an attack with NSA, and for which there is significant SIA interest.</td>
<td>WOLFRAMITE R&amp;D and definition.</td>
<td></td>
</tr>
</tbody>
</table>